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CONTENTS OF VOLUME XXVIII

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THE PSYCHOLOGICAL REVIEW

THE TRULY PSYCHOLOGICAL BEHAVIORISM

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The swing of present-day psychology toward what is known as behaviorism is due to the recognition, explicit or implicit, of the over-abstraction of traditional psychology. In ever greater numbers men endorse the behavioristic platform and turn from the exclusive pursuit of mental process or function to concern themselves with the individual in reaction on his concrete environment. The writer of this paper is convinced of the hopeful significance of this adoption, by psychologists, of the cardinal principle of behaviorism. But the widening of the psychological outlook has its attendant risks. In their revulsion from psychological abstractions there is danger that our *soi-disant* psychologists turn away from psychology altogether; in their uncritical adherence to behaviorism there is danger that they fail to challenge its conceptions and to distinguish its divergent types. This paper proposes a study of these conceptions and types.

Behavioristic psychology, as it exists to-day, is the study of the animal in reaction on his environment. Two forms must be sharply contrasted. (1) The first, extreme behaviorism, distinguishes the human animal from non-human animals solely in terms of his type of bodily reactions. This means that extreme behavioristic psychology denies or ignores what are known as mental phenomena. Its categories are qualitatively the same as those of the behavioristic study of non-human animals. (2) Modified behavioristic psychology attributes to the human animal, the object of its study, consciousness as well as bodily reaction; it teaches that consciousness is directly or immediately observed; and it accordingly distinguishes psychological from non-psychological behaviorism in that the former involves not merely the observation of physiological reactions but self-observation, or introspection, as well. To a study of these two forms of behaviorism, Parts I. and II. of this paper are devoted. The concluding section will sketch a behaviorism of a somewhat different type.

I. Extreme Behavioristic Psychology

The most prominent upholder of radically behavioristic psychology is Professor John B. Watson, and the most systematic presentation of his doctrine is his recent 'Psychology from the Standpoint of a Behaviorist.' Upon this book the following discussion is mainly based. Psychology, according to Professor Watson, is the study of the reactions that the totally integrated 'individual makes to his environment.'[1] By 'individual' is meant the human body. Psychology is, accordingly, distinguished from physiology precisely and only in that physiology is concerned with 'the functions of the special organs,'[2] whereas psychology deals with the 'whole organism' in its relation to 'its environment as a whole.'[3] Consciousness, sensation, perception, attention, emotion, thinking, memory and will are either ignored on the ground that the psychologist 'can get along without them'[4] or they are 're-defined in conformity with behavioristic psychology,' that is to say, in terms of the organism's reactions to the environment.

Upon this foundation Watson erects a simple edifice. He studies the human animal's reactions under two main heads, (1) hereditary modes of response, either emotions[5] or instincts[6] and (2) habits,[7] or acquired responses, which he distinguishes

[1] *Op. cit.*, p. 13[2]. Cf. pp. viii, 12, 20, 48, 193[3], 209 end.

[2] *Op. cit.*, pp. 19[3] f., p. 193[3] *et al.* (Note the qualification of this statement, p. 19[3].)

[3] *Op. cit.*, p. 20[1].

[4] *Op. cit.*, p. viii.

[5] *Op. cit.*, Chap. VI., pp. 195 ff.

[6] *Ibid.*, Chap. VII., pp. 231 ff.

[7] *Op. cit.*, Chap. VIII., pp. 269 ff.

both as explicit or implicit[1] and as verbal or non-verbal.[2] In more detail: instincts are marked off from emotions both as relatively coördinated and as involving 'movements principally of the striped muscles,'[3] whereas emotional changes include those of the glandular system[4] and are described as throwing 'the organism for the *moment at least* into a chaotic state.[5]

From both emotion and instinct, habit is clearly marked off as 'any definite mode of acting, explicit or implicit, not belonging to man's hereditary equipment.'[6] Watson rightly points out that the difference is genetic, not structural. "Instinct and habit," he says, are "undoubtedly composed of the same elementary reflexes. They differ so far as concerns . . . origin."[7] He stresses particularly the distinction between (1) explicit habits (verbal or non-verbal), the 'overt' activities of the 'whole body' or of 'the motile organs of the striped muscle system,[8] and (2) the 'implicit habit systems,' observed only 'with the aid of instruments,' consisting either in 'conditioned reflexes, in the glands and in the unstriped muscles,[9] or else in implicit bodily movements of throat, tongue, larynx or of shoulders and hands, for example. To verbal habits, in particular, Watson devotes much attention. "Man," he says, "is above all an animal which reacts most often and most complexly with speech reactions."[10] What traditional psychology calls thought—and under this head Watson seems to include both imagery and will—he identifies with language-habits. It follows that thought "is not different in essence from tennis-playing . . . or any other overt activity except that it is hidden from ordinary observation and is more complex and at the same time more abbreviated."[11]

[1] *Op. cit.*, pp. 273 f., *et al.*
[2] *Ibid.*, Chap. IX., pp. 310 ff.
[3] *Op. cit.*, p. 231².
[4] *Op. cit.*, p. 195².
[5] *Op. cit.*, p. 196.
[6] *Op. cit.*, p. 270².
[7] *Op. cit.*, p. 272².
[8] *Op. cit.*, p. 273².
[9] *Op. cit.*, p. 274².
[10] *Op. cit.*, p. 38³.
[11] *Op. cit.*, p. 325¹.

Creative thought is simply 'constructive laryngeal work.'[1]

The preceding pages, though neglecting entirely the point of greatest positive value of Watson's book (its report of the experimental study of instinctive responses of babies) summarizes the important positions of extreme, or radical, behavioristic psychology.[2] On this conception the following criticisms must be made.

The conception may be challenged, in the first place, for departing too widely from the historical conceptions of psychology and biology. Watson himself admits that 'historically considered' his 'program leaves out many of the factors with which psychology ought to be concerned";[3] and it certainly ignores the conventional conception of zoology in claiming for the study of the integrated, reacting animal the name 'psychology.'

The objection to radical behavioristic psychology is not, however, merely or mainly, its break with the traditional use of the terms 'psychology' and 'zoölogy.' The real difficulty is that radical behavioristic psychology leaves uninvestigated, or else inadequately analyzed, observed facts which must fall within the field of psychology since admittedly they are not material for physical or physiological science. This statement of course embodies the attitude of all psychologists, save the radical behaviorists themselves, toward the extreme behavioristic position that the psychologist has no concern either with consciousness or with the conscious self. Titchener and Ward, Wundt and Stumpf, Angell and Pillsbury, whatever their disagreements, are united

[1] *Ibid.*, p. 330[2].

[2] It may be added that, in spite of the generally remarkable consistency of Watson's exposition, he none the less occasionally indulges in forms of expression incompatible with strict behaviorism. Thus he speaks of self-observation as 'expressed in words' and of thought as 'couched in words' (pp. 42[2], 325[2]), singular expressions if thought really *is* language. In somewhat similar fashion, he speaks of the 'outlet' of emotion (p. 214) though emotion, as hereditary response, can hardly be conceived as having an outlet. The occasional slip-back into conventional expression is of course no proof of essential inconsistency, though it certainly suggests the untenability of the behaviorist's position.

[3] *Op. cit.*, p. 8[3].

in the conviction that perception, attention, will and the rest are genuinely observed facts of experience, that as such they merit scientific study and that psychology is the science that should study them. To this, however, Watson responds that he 'frankly' does not know what 'such terms as sensation, perception, attention, will, image . . . mean'; and that he does not 'believe that any one else can use them consistently.'[1] These expressions seem at first blush to close the discussion as effectually, though perhaps as unscientifically, as the asseveration of the sceptical countryman who, faced with the hippopotamus, still declared: 'there ain't no such animal.' But an indirect argument is left to the critic of Watson as exponent of radical behaviorism. It can be shown that he himself makes use of psychological concepts which he is unable to analyze into terms of bodily reaction. With the development of this criticism, the remainder of Part I. of this paper is chiefly concerned.

Two main instances of Watson's unsuccessful attempt to apply exclusively non-mental categories will be given. (1) He is unsuccessful, in the first place, in differentiating given sensations within a single sense-type or department. The sense-types, visual, kinaesthetic, and olfactory, for example, he readily distinguishes as different kinds of reaction, eye-movement, arm, leg or body movement, sniffing reaction and the like. But he has also to take account of the different kinds of visual, of olfactory, and of kinaesthetic sensation. And he has expressly abjured the introspective psychologist's doctrine that these are indescribable, elementary ways of being conscious. It is greatly to Watson's credit that he does not ignore this problem and that he does not try to meet it by substituting for his behavioristic conception of sensation, as *consisting in* bodily reaction, the utterly different conception of sensation as *dependent on* neural excitation. His procedure is thoroughly consistent: "If," he says, "we take a normal human subject and stimulate his retina with monochromatic light beginning with 760 $\mu\mu$ and then advancing to shorter wave-lengths, and ask him to react to them

[1] *Op. cit.*, p. viii.

verbally in order, he will say, 'I see red' from 760 $\mu\mu$ to 647 $\mu\mu$, ['I see] orange from 647 $\mu\mu$ to 586 $\mu\mu$,' ['I see] yellow from 586 $\mu\mu$ to 535 $\mu\mu$,''' *etc.*[1] In a word, Watson distinguishes these visual sensations from each other as consisting in different verbal reactions, the distinct vocal habits involved in saying 'red' and 'yellow.' Watson adds, to be sure, that 'we can get the observer to do more than name the colors' but his instances of non-verbal reaction to 'fine differences' turn out to be such as wine-tasting and silk-buying, complex responses, and not simple sensory reactions at all. It is in truth impossible to imagine any save verbal reactions which serve invariably to distinguish the bodily response to objects differing only in sense quality. Nothing, for example, save the verbal reaction 'blue' instead of 'white' can be supposed to distinguish one's *merely sensational* response to a blue hydrangea from one's response to a white one. But the conception of sensation-differences as distinctions of verbal reaction loses whatever plausibility it has in face of the simple consideration that in different situations different vocal responses follow on identically the same stimuli. When, for example, an untutored husband is corrected by his sophisticated wife for describing as 'pink' the chiffon scarf which she unhesitatingly calls 'cerise' it is not to be supposed that their sensations differ. The same consideration holds with regard to the different vocal responses of men of different nationality to the same stimulus. If one stimulates a Frenchman's retina with monochromatic light from 586 $\mu\mu$ to 535 $\mu\mu$, his reaction is 'jaune,' not 'yellow.' Obviously, the so-called sensation of yellow cannot *consist in* a verbal reaction, when identically the same sensory stimulus calls forth radically different reactions.

(2) The difficulty recurs in the case of thought, which Watson precisely identifies with language implicit or explicit and by which, it should be noted, he designates deliberative as well as purely cognitive experiences.[2] This teaching is so central to Watson's doctrine that it should be reproduced in

[1] *Op. cit.*, p. 88[2].
[2] *Op. cit.*, 332[2].

his own words. "Thought," he says, is "a bodily process like any other act;"[1] when, therefore, "we study implicit bodily processes we are studying *thought*; just as when we study the way a golfer stands in addressing his ball and swinging his club we are studying golf."[2] The implicit processes in which thought consists are largely, though not wholly, laryngeal. Indeed, the chief argument adduced for this conception of thought is the fact that 'many investigators' have 'set their subjects such problems as . . . subvocal arithmetic' and have then studied 'movements of the larynx (externally by attaching tambours to the neck)' finding 'in general good evidence of orderly movements similar to those in speaking. . . . Occasionally,' to be sure, such records of laryngeal movements "fail to appear even when a subvocal problem in arithmetic is worked out and the proper answer returned."[3] Accordingly, though Watson attributes the 'negative evidence' to 'our present inexact methods'[4] he frankly admits that this theory of 'implicit processes is largely an assumption'[5] though a 'reasonable' one, 'backed up,' he says, 'by the whole development of psychology, physiology, and science generally.' But these are generalities. If the behavioristic 'assumption' that a thought *is* a laryngeal bodily reaction, is justified, it must be possible to analyze specific dissimilar thoughts in terms of dissimilar laryngeal reactions and must be equally impossible to find resembling thoughts which consist in radically different subvocal reactions. In the attempt to meet this test the theory is utterly shattered. To take Watson's own example from geometry. On his view, the solution of a proposition consists essentially in a series of laryngeal reactions. But the identical solution of the same problem involves totally different laryngeal reactions, if the mathematicians talk in different languages—if one, for example, speaks of *Winkel* while the other talks about angles.[6]

[1] *Op. cit.*, p. 325². [2] *Op. cit.*, p. 326².
[3] *Op. cit.*, p. 326³. [4] *Ibid.* [5] *Ibid.*, p. 326².
[6] Henry More's spirited criticism of nominalistic doctrine, written more than two centuries ago, makes what is virtually the same point. "To call these Secondary Notions mere Names is," he says, "sheer nonsense. For on that supposition, since

To elaborate this criticism would be futile. Radical behaviorism, whatever its achievements, its discoveries, and its uses, simply is not psychology at all. For it confessedly ignores facts which psychology has always treated and it fails to reduce to terms of bodily reaction those psychic phenomena of which it takes account. A behavioristic psychology, it is evident, must be behavioristic in some other sense of the term. And this conclusion leads to the study of that form of behaviorism which makes room for consciousness.

II. Modified Behavioristic Psychology

Modified behavioristic psychology—most recently set forth, though not under this title, in Professor H. C. Warren's 'Human Psychology'—differs, as has just been stated, from radical behaviorism by regarding the human animal as possessed not only of bodily reactions but of consciousness. Like every form of behaviorism, it describes psychology as 'the science which deals with the mutual interrelation between an organism and its environment,'[1] but it protests against ruling out 'the data of consciousness.'[2] In agreement with the functional psychology of the 1900's,[3] it teaches that different kinds of consciousness are themselves forms or aspects of the reaction of organisms on their environment. A characteristic argument against the deportation of consciousness from psychology is readily built up out of Warren's statements, though he does not explicitly formulate it. It starts from the premise that the concept of behavior must be

their names vary, Mathematical and Logical Notions would vary with different tongues: since certainly the Latins call the same thing by the term *Similitudo* which the Greeks call ὁμοιότης, whereas the Greeks call that ἀνολογία and λόγος which the Romans call *Proportio* and *Ratio*, and so of other notions."—'Euchiridion Metaphysicum,' Ch. XXV., end.

[1] 'Human Psychology,' p. 13[2].

[2] *Ibid.*, p. 431, note.

[3] Both forms of behaviorism are really derived from functional psychology though only modified behaviorism has run close to type. The main difference lies in the fact that the functionalists take the psychophysical organism (mind and body or mind in body) as unit of their science whereas behavioristic psychologists of every type have, at the present time, supplanted the psychophysical by the physical organism, the body. But functional psychology treats consciousness as a significant function, though coördinate with the merely physiological functions of the psychophysical organism.

widened to include the whole sensory-central-motor arc. But the central processes, it is pointed out, are known never directly, but only by inference from consciousness. It is therefore impossible to define perceiving, thinking, and emotion in terms of bodily reaction precisely because the reaction includes a central process which can be known only through consciousness. In other words: 'The brain center' cannot be directly observed or measured. 'We have to rely entirely on the results of self-observation' in order to know it. What 'we observe and report' are 'our sensations. To these, we infer, there correspond 'physiological processes in the brain.'[1]

It is unnecessary to enforce or to elaborate this decisive argument for reinstating consciousness in psychology. The trouble with the modified behaviorist is, however, that having recovered consciousness he seems not to know exactly what to do with it. For in coördinating consciousness, as a function or response of the organism, with physiological reactions, he has slurred the empirically observed difference between consciousness and bodily reaction, between the conscious self and the reacting organism. Now it well may be, as both materialistic and idealistic philosophers insist, that the difference between the mental and the non-mental, between consciousness and bodily reaction, is not ultimate. But, however superficial the difference, it is none the less real; it is indeed the basis of the distinction between psychological and non-psychological sciences. Let one, for example, compare (*a*) the experience of seeing green and (*b*) the complex bodily processes correlated with the experience, the retinal excitation, the afferent, central and efferent neural processes and the muscular adjustment. Certainly, the two occurrences (*a*) and (*b*) are not identically the same. We directly know (as all modified behaviorists agree) what we mean by seeing green and what we mean by the bodily processes described above, and while we believe that this sensation of green is either due to, or else correlated with, the complex of bodily processes, we know that the two are neither identical nor even wholly coördinate; that they are facts of different

[1] *Op. cit.*, p. 77[2]. Cf. p. 58[4].

orders or levels. This difference, however, the modified behaviorist certainly obscures and he may even end, in complete disregard of his basal conception of consciousness, by denying altogether. Warren reaches this extreme position and the critical exposition of the following pages is based specifically on his teaching.

It has already appeared that consciousness seems, according to Warren, to win its place in psychology by the fact that the central nerve-processes, so far from being facts directly observed, become facts for the scientist only by inference from mental phenomena to which (to use Warren's occasional phrase) the brain processes correspond.[1] But instead of abiding by this neutral and impeccable phraseology of correspondence Warren adds: 'the central effect of stimulation observed in ourselves is called a sensation.'[2] "*Both sensations and ideas*," he elsewhere says, "*are central processes*";[3] and again, "the resulting central process is . . . an idea."[4] By another set of statements Warren conveys the same teaching under cover of an 'as.' Thus, he declares that 'self-observation is examination of the central adjustment phenomena as mental states';[5] and again, that 'one observes in himself as volition' a 'complex central process.'[6]

The insuperable obstacle to this literal identification of consciousness (of perception or volition, for example) with brain process has already been named: the two are different to direct observation. 'Tasting saltiness' is no more truly identical with a metabolic variation in a brain-center than with a laryngeal reaction; or (to re-state the position), it would be impossible to substitute, in intelligible discourse, a term descriptive of some internal temporal lobe process for the phrase 'tasting salt.' The brain process may indeed be inferred as cause or correlate of the consciousness but the two simply are not identical.

[1] *Op. cit.*, p. 77². Warren's statement is that 'our sensations . . . correspond to the physiological processes in the brain.'

[2] *Ibid.*, p. 77¹.

[3] *Ibid.*, p. 230³. Italics Warren's.

[4] *Op. cit.*, p. 226³.

[5] *Ibid.*, 410¹.

[6] *Ibid.*, 402³. Cf. pp. 11⁴, 131¹, 257³, 436 (2).

It is difficult to understand how Warren can have made this identification in view of his earlier doctrine of the function of consciousness. For if, as now appears, sensations and ideas *are* central processes it is futile to teach that the central processes are *known through* sensations. The confusion is only thickened by Warren's designation of his theory as a '*Double-Aspect* hypothesis' of consciousness which assumes 'that conscious and neural phenomena constitute *one single series* of events.' "When they 'happen to me,'" Warren says, these events "appear as conscious experiences, when I observe them indirectly, through perceiving the behavior of other beings, by means of my senses, they appear in the form of motion, chemical change, and the like." [1] In more detail: "When," Warren says, "we are affected by a loud sound or a brilliant color we observe the phenomena in a different way from that in which we observe these forces affecting the ears or eyes of another human being. . . . Your friend's memories are observed by you only indirectly—you listen to his verbal description of them. . . . Your *own* memories are a direct and immediate part of your life." [2] This is indeed a vivid description of the distinction which we actually make between consciousness of ourselves as hearing and seeing and consciousness of gesturing bodies or of sounding voices. But this vivid description, far from showing that the "phenomena called *conscious experiences* . . . form part of the 'total description' of nerve activity," [3] not only emphasizes once more the sharp distinction between 'immediate life' and inferred neural phenomenon, but also definitely implies the conscious being, or *I*, which has these two 'ways of looking at the same set of facts.' To discuss in detail the 'double aspect theory' is, however, beside the purpose of this paper. That theory is, as Warren himself very frankly acknowledges, one hypothesis among others. He adopts it as 'the best working tool for psychological investigation,' [4] but admits that the interaction theory, also, could 'bridge the gaps in conscious

[1] *Op. cit.*, p. 415².
[2] *Op. cit.*, p. 9³ f.
[3] *Op. cit.*, p. 415³.
[4] *Op. cit.*, p. 416¹.

experience' and 'supply the missing data of brain activity.' There is reason, indeed, to suspect that Warren rejects interactionism rather through the fear—in the opinion of the writer unfounded—of its inevitably indeterministic tendency than for strictly psychological reasons. And if the suspicion turn out to be well founded it will be necessary to protest against this incursion of philosophical theorizing upon psychological description. For the double aspect hypothesis, like interactionism, is after all a metaphysical theory and the psychologist *as psychologist*, should no more be interactionist, parallelist, epiphenomenalist or upholder of the double aspect theory than he should be idealist, dualist or materialist.[1]

Upon this consideration of the basal conceptions of modified behaviorism there would naturally follow a discussion of its treatment of the specific facts of psychology. It will, however, be convenient to postpone this to the following section of this paper. The preceding pages may be very briefly summarized: Modified behaviorism, in the form which Warren gives it, while it starts out from the conception of consciousness as distinctive function of the organism, too readily identifies consciousness with neural process. With this identification, however, modified behaviorists fall back to the untenable position of the extremists, involving themselves often in metaphysical considerations beyond the scope of psychological inquiry.

III. Behaviorism as Self-psychology

The preceding sections of this paper have emphasized the crucial objections to current behavioristic psychology in both its forms. Yet it does not follow, in the view of the writer, that the cardinal principles of behaviorism must be aban-

[1] The same suspicious commerce of psychology with philosophy marks Mrs. De Laguna's interesting discussion of 'Emotion and Perception from the Behaviorist Standpoint' (Psychol. Rev., 1919, 26, 409 ff.). In her first paragraph she virtually acknowledges that her main interest in behaviorism is due to 'the importance of the philosophical advantages' which it offers. "The American neo-realists," she says, "are of peculiar interest to us" (to us behaviorists, she means) "in that they identify the act of awareness with selective activity of the nervous organism in responding to those features of the environment and body which act as stimuli." (*Op. cit.*, p. 416[1].)

doned, in other words, that psychology must give over studying the integrated individual in relation to his environment. For the criticisms of behaviorism, it is most important to observe, have been directed simply against the behaviorist's fashion of describing the relation of individual to environment. The outcome of this criticism has been in the first place (1) to show that the individual's relation to environment is not to be identified exclusively with bodily reaction, that it consists, in part at least, of consciousness; and in the second place (2) to show that consciousness is not a function strictly coördinate with bodily response, that it is in truth a more fundamental relation. These criticisms, to be sure, assail the central doctrine of behaviorism, its conception of the reacting individual if, as has always been assumed, the individual of the behaviorist must be identical with the animal body. But precisely this assumption is challenged by every psychologist who regards his science as a study of conscious self (person or mind). For the self (that which everybody means when he says 'I observe myself') is, as truly as the organism, an individual, and the self as individual is unaffected by the criticisms, just restated, of behaviorism since it is related to environment not primarily by bodily response but by consciousness. *Self-psychology*, accordingly, that is, psychology treated as science of self, is *behavioristic when it stresses the relation of self to environment.*[1] To the development of this thesis, the final division of this paper is devoted. It purposes not to re-state the reasons, many times formulated,[2] which have led to the conception of psy-

[1] It may, of course, be argued that the term 'behavioristic' should, in the interests of expediency, be abandoned to the exclusive use of the biologists. I incline to question this conclusion but am not especially concerned with the verbal dispute. This footnote offers opportunity, however, to protest against a genuine perversion of the meaning of 'behavior.' Considerations of priority and convention certainly oppose the procedure of the Clark University introspectionists who often attribute behavior to the mental processes themselves. (Cf., *e.g.*, S. C. Fisher, 'The Process of Generalizing Abstraction,' *Psychol. Monog.* No. 90, p. 92[2] *et al.* "The experience of similarity of a feature under investigation," Dr. Fisher says, ". . . consisted largely in the behavior in consciousness of the percept of the feature itself.")

[2] Cf. J. Ward, 'Psychological Principles,' Chap. II.; M. W. Calkins, 'A First Book in Psychology,' Chap. I. and Appendix, Sect. I. (with Bibliography, p. 282);

chology as study of the self, but to show that self-psychology is the science of (*a*) a behavioristically conceived individual, the self, in (*b*) behavioristically conceived relations to (*c*) a behavioristically described environment.

(*a*) To carry out this programme it is first necessary to show that the self is an individual in the behaviorist's sense of the term. Now the two basal characters of the biologist's individual, the animal organism, are the following: first (1), its integrated or *coördinated totality*, its wholeness, as contrasted alike with the elements and processes of the merely structural psychologist and with the special functions of the physiologist;[1] and second (2), *relatedness to its environment.*[2] Less emphasized but unquestionably included in the behaviorist's conception of the organism are the following characters; (3) a *relative permanence* implied in its retentiveness and plasticity, its habits and its dispositions, which Warren calls 'more or less permanent attitudes';[3] (4) *growth* or development;[4] and finally (5) *individuality*, implied particularly in the constant contrast made by Warren between 'our own mental life as each one observes it in himself' and 'mental life as observed in others.'[5]

Organized totality, relatedness to environment, persistence, changingness, individuality—these, however, are not merely characters of the human organism. For, in precisely these terms the self is described. It is certainly (1) a concrete, integrated being, a totality of varied experiences. In the words of Bertrand Russell (a Saul among the prophets) 'thoughts and feelings do not occur when there is no self for them to belong to.'[6] Both its persistence (2) and its growth

'The Self in Scientific Psychology,' *Amer. J. of Psychol.*, 1915, 26, pp. 505 ff.; E. A. Gamble, 'A Defence of Psychology as Science of Selves,' *Psychol. Bull.*, 1915, 12, pp. 195 ff.

[1] Cf. Watson, *op. cit.*, pp. viii, 20, 40, 48, 193[3], 209; and Warren, *op. cit.*, pp. 11[1], 92 *et al.*

[2] *Op. cit.*, p. 1. Cf. pp. 9, 20, 30[2], 92[2], 197[1]. And cf. Warren, *op. cit.*, pp. 1, 8, 10, 30 *et al.*

[3] *Op. cit.*, p. 367[4].

[4] *Ibid.*, pp. 391 ff.

[5] *Op. cit.*, p. 215[1]. Cf. pp. 9[3], 383[3], 415[2].

[6] *Scientific Method in Philosophy*, Lect. III., p. 75[1].

(3) are discovered in its recognizing and anticipating; its individuality (4) in its emotion and willing. Finally, (5) the self is, in the words of Ward, "the living subject in intercourse with his special environment."[1]

(*b*) These last words indicate that self-psychology is, in the second place, behavioristic in that it takes explicit account of the complex of objects constituting the environment. This direct contact with everyday reality is not the least of the attractions of behaviorism. In flat opposition to conventional psychology, which lavishly correlates psychic objects with physical and physiological 'stimuli' but firmly refuses to relate them to 'objects,' behaviorism insists that the psychologist must refer to the environment, physical and social, to which his integrated individual reacts. So Watson, in his introductory chapter, traces the derivation of psychology from our 'common-sense procedure' in learning to control people and to deal with situations[2] and everywhere holds that the psychologist must concern himself with the whole environment.

Once more, the self-psychologist endorses completely this behavioristic emphasis on environment. More than this, he is qualified, as the behaviorist is not, to describe in technical terms the distinctions between different sorts of objects: (1) the basal distinction, always employed but never explained by the biological behaviorists, between the impersonal 'physical' and the personal 'social' environment; (2) the distinction between the private, relatively unshared objects of imagination and the public or common shared objects of perceiving and thinking. With the details of this procedure we are not here concerned. The point at issue is simply this: that the self-psychologist has the behaviorist's conception of the environment.

(*c*) Self-psychology has finally to show that it conceives behavioristically not only self and environment but also the relation, consciousness, of self to environment. At the out-

[1] *Psychological Principles*, p. 17[2].

[2] *Op. cit.*, pp. 3–5, 7 ff. Mrs. De Laguna's attempt to endow the 'common-sense' object with such affective characters as inimicalness and hatefulness is another illustration of this fundamental behavioristic tendency. (*Op. cit.*, p. 416[1].)

set, it is obvious that most of the biological, as distinguished from the physiological, categories of behaviorism—namely, instinctiveness, habitualness, immediacy, coördination and their opposites—are as applicable to consciousness as to bodily response. Thus, for example, fear is as instinctive as flight, and the perception of my fork is as habitual, as immediate, and as coördinated as the impulsive movement of my hand toward the fork. For the rest, the difficulty in showing that self-psychology is behavioristic in its treatment of consciousness is due mainly to the difficulty in discovering any characteristically behavioristic conception of consciousness at all. For the behaviorists, in the words of Mrs. De Laguna, have 'left . . . the classical categories of psychology—sensation, perception, emotion, affection, volition, *etc.*, . . . almost wholly to the undisputed sway of the traditional psychology.' [1] Warren, for example, devotes six chapters to a description, in structural and non-behavioristic terms, of the mental life as consisting of 'a succession of mental states.' [2] Yet Warren also suggests a truly behavioristic conception of consciousness when he introduces the conception of the attitudes which 'a man takes toward the situations which confront him.' To be sure, Warren defines the attitude, in psychophysical terms, as the subjective aspect of the 'general set'—in other words, of the 'traces which previous stimuli and impulses have left in the nerve-substance.' [3] Certainly, however, the specific attitudes which he considers are modes of behavior, reactions to environing objects. They include *interest*, described as 'our mode of receiving perceptions of the external world . . .;' [4] *desire*, 'the attitude which develops in connection with the . . . feelings,' [5] and *attention*, 'our kinæsthetic attitude.' [6] These are called primary attitudes whereas emotional dispositions and volitional proclivities are examples of what are named secondary attitudes. The difference between

[1] *Op. cit.*, p. 410[2].
[2] *Op. cit.*, Chaps. XI.–XVI., pp. 215–359. Cf. p. 354.
[3] *Op. cit.*, Chap. XVII., p. 360.
[4] *Op. cit.*, p. 362[3].
[5] *Op. cit.*, p. 363[4].
[6] *Ibid.*, p. 364[3].

belief and disbelief is also said to consist 'not in the feeling but in the *attitude* which we assume.'[1]

It is evident, at first glance, that these are attitudes of the self quite as truly as of the organism. To take Warren's examples; I, the self, even more truly than I, the body, am interested and desire and attend; have dispositions and proclivities; believe and disbelieve; am possessed of conscience and appreciation. In a word, the self-psychologist, as truly as the modified behaviorist, can describe consciousness as a complex of the attitudes of individual to environment. As a matter of fact, self-psychology, at least as far back as 1901, introduced the term '*attitudes*' to designate the varying relations of self to environment.[2] And, six years later, in Professor Judd's 'Psychology,' consciousness was systematically described in terms of 'the different attitudes which we assume toward our impressions.'[3] The detailed discussion of these doctrines of the attitude, as held by self-psychologists, would lead us too far afield. But it should certainly be stated that the more complex attitudes have been analyzed into simpler. And these more fundamental and simple attitudes include at least the following: receptivity and activity, attention directed outward or inward, and participation, or awareness of sharing the experience of other selves.[4]

[1] *Op. cit.*, p. 304².

[2] Cf. the writer's 'An Introduction to Psychology,' 1901, pp. 152¹, 169, 254², 270², 306¹. (It should be noted that in this book the meaning of 'attitude' was restricted, unjustifiably, to the relation of self to *other self.*)

[3] 'Psychology. General Introduction,' 1907, pp. 68 f., 134 f., 240, 306 f. Cf. also *J. of Phil., Psychol., &c.*, 1908, 5, 676 ff., where Judd re-states this conception of the attitudes or 'subjective reactions' of the individual.

[4] Cf. the writer's 'A First Book in Psychology,' pp. 3, 333 f., and *passim*. Cf. also James Ward, 'Psychological Principles,' p. 57² on the distinction between the 'sensory or receptive' and the 'motor or active attitude' of attention.

It may be added that the German term *Bewusstseinslage*, which Titchener translates 'attitude,' made its appearance in year 1901, also, in the first instance seemingly to designate any predominantly non-sensational and non-affective consciousness. (Cf. K. Marbe, 'Experimentell-Psychologische Untersuchungen über das Urteil,' 1901, Mayer u. Orth, 'Zur qualitativen Untersuchung der Association,' *Zeitschr. f. Psych. u. Phys. d. Sinnesorgane*, 1901, XXVI., 1 ff., and Titchener, 'Experimental Psychology of the Thought Processes,' esp. 100 ff. and 244 f.) From the first the term has suffered for lack of definition, but the examples of *Bewusstseinslagen* are clearly mental attitudes—doubt, affirmation, uncertainty, *Zwang zum Vergleichen* (Marbe, *op. cit.*, pp.

In this fashion the self-psychologist argues that he has the only genuine behavioristic psychology—a psychology which studies the totally integrated individual in the attitudes with which it confronts its environment. At this point, however, he is likely to be met with the complaint that self-psychology, compared with behaviorism, is, after all, as 'water unto wine,' a thin and empty substitute for what James might have called the thickness of behaviorism, its richness of content, its heaping of observation on observation. To this criticism two replies may be made. It may be pointed out in the first place that nothing forbids the incorporation in self-psychology of all the observations of the biological behaviorists. It has already been shown that mental attitudes as readily as bodily reactions may be distinguished as distinctive or acquired, habitual or novel. Furthermore, every self though it is not a human body has a body and to this body it stands in more intimate and significant relation than to any other object of its physical environment. There is accordingly no fact about instinct or habit, biologically regarded, and no phenomenon of striped or unstriped muscle, ductless gland, summation or distribution of impulse, which may not become a relevant, even if a subordinate, part of self-psychology. The self-psychologist should not, however, content himself with appropriating the riches of behaviorism biologically conceived. In the phenomena of social, differential, and abnormal psychology he has rich and, for the most part, unworked resources of his own, concrete facts of human experience indescribable except in these terms of personal relation which are the categories of a behavioristic self-psychology.

18, 30, 87, 60). Titchener, in his 'Textbook' and his 'Beginner's Psychology,' has adopted the 'mental attitude,' with seeming disregard of its behavioristic and self-psychological implications.

AN ATTEMPT TOWARD A NATURALISTIC DESCRIPTION OF EMOTIONS. (I)

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The records of recent psychological history incline us toward the view that the descriptions and theories of emotions are for the most part inspirited by the necessity to specify the precise causal connection between mental and physiological states. Thus James was interested to point out that the accepted sequential order of the mental and physiological should be reversed. What influenced James to formulate his theory was not merely the conviction that emotions are primarily organic or physical, since James was himself a subjectivist; but rather he was interested to substantiate the belief that emotions are not in any sense entitative mentalities expressing themselves in physiological action after being aroused. That the significance of James's theory lies not in the emphasis of organic resonance, but rather in the assumption that an emotion is the subsequent awareness of organic disturbances, is convincingly evidenced by the fact that the assertion of the organic basis for emotional conduct is centuries old.[1]

But now that the entire subjectivistic tradition in psychology is being challenged and tested, it seems appropriate to attempt an evaluation of emotional conduct not with regard to any causal sequence, but solely upon the basis of an observational correlation of the stimulating circumstances and the organism's responses to them. In the following discussion the writer proposes to submit a series of propositions, which it is hoped will serve to suggest an interpretation of emotional conduct from an objective and naturalistic standpoint.

[1] Cf. Titchener, E. B., 'An Historical Note on the James-Lange Theory of Emotion,' *Amer. J. of Psychol.*, 25, 427–447.

I

The Nature of Emotional Conduct.—Emotional conduct consists of interrupting forms of action stimulated by rapidly changing circumstances, in some cases accompanied by various intense organic processes which sometimes facilitate the immediate performance of a new act.

It is absolutely important for the understanding of emotional conduct to note that the primary occurrences in such action are the confusion and excitement which disrupt the behavior ordinarily taking place when the emotion-exciting stimulus appears. When we attempt to describe the specific characteristics of an emotional act we are profoundly impressed with the condition of disrupting chaos and inhibition of action which occupies so large a place in the emotional situation. We may look upon the emotional person as practically paralyzed for a moment; he appears to undergo a dissociation of his reaction systems; so that he remains powerless and helpless until his responses are reconstituted. This reconstitution may be superficially described as a refocussing of the person toward some definite object. Essentially, emotional conduct is a momentary condition of 'no response,' since there appears to be a complete cessation of all directed responses to surrounding conditions. In point of fact, it is this disruptive chaos which definitely marks off the milder emotional activities from the numerous classes of so-called feeling behavior to which they otherwise display striking resemblance.

In detail, the 'no response' phase of the act is a natural consequence of the fact that the perceptual phase of the behavior segment cannot be followed by an overt act. In such a case the perceptual phase of the activity is an implicit response situation. When it is possible for an overt activity to occur, then there is no emotional object or condition. But whenever a dangerous object or other emotion-exciting stimulus appears, or when we meet with and recognize a dangerous situation and cannot do anything about it, we are in an emotional condition and perform an emotional response.

The emotional response, then, is not the definite functioning of an organized reaction system; in fact it is quite the opposite. In other words, we are not possessed of a large number of definite potential emotional reaction systems, in the sense that we are prepared to make specific disruptive reactions to definite objects of stimulation. In the case of various informational or habit activities, however, the organism does have definite potential response systems in its functional equipment. Thus for example, the verbal stimulus 'who was victor at Salamis?' or the perceptual presentation of the word 'loan' in stenographic notes will bring out definite overt responses which were acquired in a previous time and which are called into action by the present stimulation. Not so, however, in the case of emotional behavior in which no definite response system is functioning. What really happens to the person in the emotional situation is, that in the absence of what, from a behavioristic standpoint, may be called a required response system, the individual is thrown back upon any available behavior resources. In the most turbulent situations the person can substitute only visceral reflexes, and such behavior we may call the elemental emotions. In contrast with this condition, that is to say, in the more typically cultural situations[1] the person replaces the required response system with one serviceable in some similar circumstance (laugh when caught in a socially disapproved act, as though it were a deliberate joke), or with some response previously associated with the required act in this particular environing condition (smile profusely instead of answer question).

Assuming that we can agree that emotional behavior consists essentially of a disruptive disorganization of responses we might still question whether this diffuse and chaotic functioning of the organism offers a valid criterion of differentiation of emotional from other types of behavior. For we might recall that other types of psychological behavior also

[1] By the terms elemental and cultural the writer plans to point out a difference in behavior circumstances as illustrated by coming upon a dangerous animal in a wood and by being informed of a legacy.

show marked reactional disturbances. In the following exposition we propose to point out that despite the apparent superficial similarities, emotional conduct presents marked behavior factors different from those of other types of psychological action.

Let us pause here to inquire briefly into the conditions responsible for the irregularities of human behavior marking the general spontaneity of all psychological activity. First, we must note that all psychological description consists primarily of all the enumerative factors comprised within the arbitrarily chosen boundaries dividing off one segment of the organism's activities from all that precedes and follows. Such a segment of behavior we may call an act, or if we choose a pattern of response. Now every such act is a product of a series of stimulating objects or conditions and response systems, some one or a few of which give a name to and characterize the act. Indispensable in the extreme for the understanding of emotional behavior at this point is the careful distinction between response systems and patterns of response. Patterns of response consist of series of definite response systems organized in contact with particular stimuli and excited to action by them. Ordinarily, the definiteness and regularity, as well as the predictability of an act, depend upon the specific correlation of a definite reaction system with some particular stimulus. Whenever the organism possesses a definite response system of some sort, capable of excitation by a specific stimulus, we may expect an orderly and more or less compact act or pattern of response. Even here the act is spontaneous and variable, provided that the context or setting of the stimulus is modifiable. This sort of situation is well illustrated by the web-spinning of spiders in which the slight modifications of the context of the stimuli makes possible the hardly perceptible differences in web-spinning. In human informational and habit modes of action a somewhat greater invariability and unconformity to type are introduced by the greater possibilities of variation in the settings of the various stimuli. Clear it is, therefore, that notwithstanding the wider or narrower latitude for irregularity of behavior supplied by the variability in the setting of the stimulus, there is, of course, a fundamental describable regularity in all of our behavior which comprises organized response systems.

Here then we have a clue to the explanation why emotional conduct lacks even the remotest resemblance to order or regularity, namely the absence in such conduct of an organized reaction system. The lack of a stimulus-response integration can be more readily appreciated when we consider that the very circumstances under which emotional behavior occurs make it impossible for the person to develop response systems with which to adapt himself to those circumstances.

Moreover, this lack of a response system makes it possible to see why in the emotional situation the only basis for predicting the behavior of a person is the influence of the surroundings at the moment, and it is only because the surroundings are such as to determine the intensity of the person's dissociation, that we are able to describe, however inadequately, the comparatively large segment of behavior which includes the emotional act.

To the writer it seems that the absence of a definite response system in emotional behavior explains the following facts, and furthermore, unless there are other satisfactory means of accounting for these facts they tend to support the hypothesis that an emotional act is essentially a 'no response' phase of behavior. The facts are: (1) the impossibility of an onlooker to specify what sort of emotion a person is experiencing from any observation of the individual aside from the emotional circumstances, (2) the hitherto complete failure of psychologists to be able to make any satisfactory classification of emotional acts. (3) Furthermore, is it not the absence of a response system in emotional behavior and its replacement by reflexes which makes it easy for psychologists to misinterpret emotional acts, and to look upon them as mere bodily 'changes' or 'expressions' of invisible states of mind? (4) Again it appears that only 'no behavior' conduct could induce psychologists to interpret emotions as the awareness of organic changes or to look upon the substituted visceral reflexes as instincts wihch protect the organism pending the arousal of the awareness of what is to be done in the situation in question. (5) And finally, the view that the same emotions are found in the animal world as in human action equipment may be traced to the fact that psychologists were observing in the human organism not definite reactions but replacement responses which do in part resemble the simple organized activities of animals.

Although the disruptive chaos may be taken as a definite mark of differentiation between emotions and other forms of behavior, it should not be considered as in any sense an exhaustive description. In the actual description of a concrete emotional situation we must include many other essential features, although chief reliance must be finally placed upon the absence of a focussed reaction system. When we thus take cognizance of all the factors in a behavior situation it becomes impossible to confuse emotional conduct with the hypnagogic dissociations in which the person is temporarily cut off from his surroundings, or with the attention shift in which there is merely an orderly reconstitution of reaction systems as a preparation for a change in behavior. To give always as full a description of behavior as possible would mean that we might avoid mistakes that now are most flagrantly indulged in, namely, calling certain acts emotions which clearly are not, such as passions, sentiments, and habits of affective response, or identifying as something else actions which are emotional in character.

Lest someone inject into the description of emotional behavior any teleological notion concerning the lack of response, we might suggest forthwith that the assumption of such a lack of a response system is based directly upon the immediate facts of the emotional situation. The fact is, that in any specific emotional situation the contextual stimuli and the associated activities that occur, clearly indicate that a particular kind of stimulus-response correlation should be a significant factor in the segment of behavior under observation. In some instances we can determine with little chance of error what the person may be expected to offer in the way of an organized and directed activity in a particular situation.

If in each case of emotional conduct the fundamental principle is the absence of a certain response system the question arises as to how to distinguish between the more and less violent emotional activities. Here as elsewhere in the investigation of emotions the only safe and sufficient guide is the consideration of the specific conditions under which the behavior occurs. As we have already pointed out the person may be found lacking a response system in a situation in which the greatest immediate need for definite action seems to dissociate him until he is left with only his simplest elementary behavior, while in other situations, events do not occur so suddenly, nor are the circumstances so pressing as to bring about even very marked surface confusion. In the milder situation there is, in fact, only a slight difference between the activity interrupted by the emotion-exciting stimulus and the resumed occupation after the emotional period is over. Consequently, the milder sorts of emotion seem to merge with the non-emotional situation in which a definite response is merely delayed or inhibited because of the person's lack of attention to a certain stimulus, or because of a momentary failure of perception.

II.

The Systematic Analysis of Emotional Acts.—As a distinctive segment of psychological activity an emotional act can not only be separated and distinguished from its preceding and succeeding contextual correlatives, but can be analyzed into its functionally constituent phases. And thus we may distinguish in the emotional situation (1) the perceptual phase, that is, the discrimination and appreciation of the stimulus object, or the ideational preliminary to an emotional response; (2) the emotional action proper; (3) the superseding organic or other activities. Succeeding these three phases we find another segment of behavior and unless it is another emotional act, involves an organized response system.

1. The perceptual phase is an act of simple apprehension which in a given case may be an implicit appreciation of a danger or its opposite. As an incipient response system a

perceptual reaction of danger involves uneasiness, excitement, trembling, and unpleasantness, all of which are reminiscent of a previous condition of the individual in actual danger, which condition is preserved and revived in vestigial form. In a sense, the perceptual phase of the emotional situation is a preparatory response for some act which is to follow. When, as sometimes happens, the exigencies of the situation prevent the occurrence of the overt act, as for example when confronted by a dangerous animal under conditions lacking available means of escape, or when an appropriate act has never been acquired for the present frustrating and baffling circumstances, then the cataclysm or seizure which is the emotional phase proper is instantaneously irrupted.

At this point it is worth noting that an emotional complex cannot include a primary perceptual act[1] as an antecedent function. For in such a case the primary differential reaction, or the meaning activity, is a directly operating overt response in the form of a definite adjustment, and therefore can never invoke a confusional, disruptive response activity, such as we find in emotional conduct.

As compared with the perceptual anticipatory phase of emotional action, the ideational antecedent of the emotional act is a more refined and more vague vestige of an original danger or other response; it is brought into operation through a substitution stimulus for the original danger situation. The statements just made presuppose an idea to be a definite act which incipiently[2] repeats a previously direct overt adjustment, or what was in a former time a precurrent or preparatory activity such as reading something, or hearing imparted information. In the case of such an antecedent act, the emotional behavior is much milder, and the organism does not as a rule get so much out of hand as in the case of the emotional situation preceded by a definite perceptual reaction. It must be understood, however, that the violence of an emotional activity is entirely due to the surrounding circum-

[1] By primary perception is meant the directly operating exteroceptive type of consummatory behavior. In primary perception the precurrent and consummatory (we borrow these terms from Sherrington) phases of activity are identical.

[2] And in many cases symbolically.

stances; so that the emotion following an ideational process might possibly be far more turbulent than one which is preceded by a perceptual activity.

2. The emotional activity proper may be described as a process of disintegration of the series of response systems constituting the individual at the moment. In effect, there is a total inhibition or suppression of all activity so far as any overt adjustmental response is concerned. Essentially, the emotional factor is a phase of behavior in which there is lacking a coördinate stimulus-response process ordinarily resulting in a definitely directed act. Such an act when it occurs may be looked upon as a consummatory response which is initiated by the precurrent perceptual or ideational action, and when this act does take place we call the pattern of response a volitional or habitual adjustment. The typical commotional seizure and chaos, is then, the direct consequence of the non-operation of a consummatory reaction when its appropriate antecedent has functioned. According to our hypothesis it appears that an emotion is intrinsically a negative form of behavior although it may serve to induce or accelerate another adjustment.

3. Because every psychological act is the reaction of an organism, it is an invariable law that whenever a stimulus fails to produce its appropriate response the organism is forced to fall back upon some substitution or replacement act. We have already suggested that in the most striking emotional situations the replacement acts are interoceptive reflexes. Hence we find an almost universal emphasis upon organic processes as prominent factors in emotional behavior. Naturally there will be a great difference in the amount and intensity of such organic activity when we compare the elemental behavior, sometimes called the violent emotions, and the cultural conduct usually referred to as the subtle or tender emotions.[1] In the latter case, it is universally true that whether the stimulus is perceptual or ideational there is always possible some measure of direct adjustment and therefore there is less organic functioning.

[1] Not sentiments or diffused feelings.

If we accept as a fact the difference between the elemental and cultural emotions we may then specify some of the conditions in the more violent and pervasive emotional action, and assume that the descriptions will hold for the simpler activities with merely a variation in the degree of the organic components. And first we may note that the supplied organic activities involve vascular and visceral processes of all sorts. There are disturbances of the digestive secretions, respiration, contraction of blood vessels, acceleration or retardation of the heart beat, induction of various secretions, etc. Very frequently we find also as substitutes for definite focussed responses, imperfectly articulate cries which in most cases answer better to the description of groans or screams than to language. Still other substituted actions are the numerous random activities of the skeletal muscles sometimes becoming so exaggerated in emotional behavior that persons assume poses of cataleptic rigidity.

Following very closely upon the emotional activity proper the person may begin an act which is directly conditioned by the stimulating circumstances surrounding him at the moment. Naturally the type of response will depend upon the circumstances which initiated the emotional activity in the first place, since we are here observing what is after all a definite and restricted event. In the case of a primary emotion the activities are large overt responses involving the external skeletal muscles, as in fighting, running, and jumping. It is in such cases that the preceding definite emotional conditions may be of service. In the secondary emotional situations the transition from the state of suspense and confusion is more gradual and in fact the whole emotional situation is more of a piece with other activities than is true in the primary emotions. In other words, the specific emotional action is decidedly less marked off from preceding and succeeding segments of behavior. The directed responses following an emotional situation are then very rigidly determined by the surrounding stimulating objects and in all types of emotional conduct are at first diffuse and not especially well directed for the needs at hand. The recovery is indefinitely more rapid, however, for the cultural emotions, since as we have already seen, in these cases the organism is never shaken to the reaction foundations. In all cases, however, it must be noted that when the final activity once begins the emotional action proper has ceased to exist. This directed act or adjustment must be considered as a consummatory act following a precurrent response which is not identical with the anticipatory phase of the emotional act. It is, therefore, from the standpoint of the stimulus, a new and not merely a delayed reaction. So disparate are the emotional acts and the adjustments which follow them that in any given emotional situation the presentation of a new stimulus, no matter how remote from the emotional situation, will strikingly curtail the emotion. Such a situation is well illustrated by the student suffering an emotional confusion while being orally examined, but who recovers immediately when he attempts to make some reply, however unsuited to the question.

III

Some Points of Contact between the Organismic[1] *Hypothesis and the James-Lange Theory.*—Our analysis of emotional conduct suggests a basis for reëxamining some of the discussions centering about James's formulations of emotions. One of the essential points in the discussion turns about the problem of harmonizing the directness and immediacy of emotional conduct with the apparently necessary cognition of what sort of act should occur. The pre-Jamesian view was interpreted in the following manner. The stimulus object excites a mental state (emotion) which is followed by its appropriate bodily expression. Not unlike his predecessors James was a mentalist, and consequently thought of an emotion as a 'state of mind,' but he saw clearly the necessity of connecting it very closely with overt activities if the description was to be at all in consonance with the facts. As a result, James was lead to assert that the emotion proper follows the bodily

[1] By the term organismic we mean to point out the absolute inseparability of the factors in an emotional or any other psychological act. Emotions as acts of a unique individual cannot be thought of as composed of parallel or interacting parts.

expression. Now, although we must admit that James's emphasis of the immediate occurrence of some act was a distinct stage in advance of his predecessors' theory, yet because he thought of an emotion as the knowledge process in the situation he could not explain why any particular behavior or expression, as he called it, should be connected with any specific mental state. The solution that he offered was that the stimulus object calls out an instinct act presumably appropriate for the occasion, and which supplies the characteristic emotional tone to the succeeding mental state.

Such a solution could of course not be satisfactory to James himself unless he could conceive of an instinct as a definite cognitive activity, a condition which runs completely counter to James's mentalistic attitude and his own vivid description of instincts as primarily physiological processes. For unless he could consider instincts to be definite cognitive processes, the fact that different kinds of acts seem to be associated with any given emotion still leaves the original problem on his hands. But if the instinct is a cognitive act what purpose can the succeeding mental state serve, since the reflex-instinct act arrogates its function? It is not surprising, therefore, that James soon gave up the notion of the instinct as the means of connecting an immediate overt act with an emotion, in favor of the idea that possibly there are differentiations in organic activities suitable enough to provide specific antecedents to the mental phases of emotions.

How differently interpreted is the entire behavior situation from an objective standpoint. Whatever the immediate act may be, its prompt occurrence following the perception of the stimulating object is a natural consequence of the phasic character of all psychological behavior, for perception is merely a precurrent phase of a segment of behavior in which some consummatory reaction is to follow.[1] And since the precurrent action is a perceptual process, no inscrutably working instinct need be here invoked. As we have attempted to show in the earlier part of this paper, it happens

[1] Cf. Kantor, 'Suggestions Toward a Scientific Interpretation of Perception,' Psychol. Rev., 1920, 27, 191 ff.

that in a segment of emotional behavior no organized response actually occurs, but instead a series of replacement reflexes. It is of course understood that each phase of any segment of behavior is the reaction of the complete organism as a biological unit. Unless one adopts an organismic hypothesis at this point, it is impossible to avoid a controversy, as the experience of James illustrates, concerning the order of emotional events.

If it is true as we have suggested, that the perceptual phase of a segment of emotional behavior brings about a 'no response' action, what becomes of the knowledge factor that seems so essential to James in common with all other writers on the emotions? Our answer to this question is as follows. In the first place, since no directed adaptation follows the perceptual phase of the segment of emotional behavior we are not obliged to assume that the precurrent perceptual response carries any further significance than the appreciation of a danger or other stimulus. And further, any definite knowledge of what is occurring in the emotional situation is a cognitional response belonging to a segment of behavior postdating the emotional situation in question. To us it seems that most of the difficulty that James had with the emotions arose from a confusion of the perceptual phase of an emotional situation with the knowledge of an emotional event after it occurs.

We believe that an objective analysis of emotional conduct reveals two kinds of cognitive factors. The first is the precurrent appreciation of an emotion-exciting object which results in a 'no response' action with substituted organic reflexes. The second is the self-expressive language act which we may call the overt appreciation of the danger situation. We repeat, that if James could have kept these two distinct and considered them as phases of a complex action, he could have obviated the entity interpretation while still doing full justice to the conception of emotions as rapidly occurring acts in which running or striking follow directly upon the perception of some stimulating object.

Another essential feature of the Jamesian theory of emotions, which becomes clarified by our organismic hypothesis, is the shift which we have intimated James effected in the expressions of the emotions. Let us recall that in the 'Principles' he mentioned as antecedent expressions such overt directed responses as crying, running, and striking, and that in the 'recantation of heresy' article[1] he modified his view to stress visceral activities. This shift was stimulated by the critics of his theory who pointed out that entirely different expressions might give rise to the same emotions,[2] and bespoke an endeavor to find less inflexible touchstones of his theory. In supplanting the exteroceptive activities with diffuse interoceptive waves as expressions of emotions, James of course weakened his theory, since he gave up what appeared to be prime prerequisites to support the denial of the antecedent mental factor in emotions.[3] James's acquiescence in what was virtually a complete retreat from his original position, was inevitable as long as he did not recognize that the factors in an emotional act are a succession of organismic responses, and not sequences of mental and physical events.

Could James have developed an organismic conception from which both antecedent and consequent mentalities are banished, he might readily have seen that the overt directed acts such as running or striking are very immediately related to the emotional situation, but need not be interpreted as concomitants of mental states. As our analysis has indicated, these overt responses are consummatory phases of behavior following very closely upon the preparatory perceptual reaction which postdates the emotional phase of another segment of behavior. In point of fact, when these running or striking acts occur, even when they seem simultaneous with the appearance of the emotion-exciting stimulus, the emotional seizure is over.

And finally, the organismic hypothesis affords us an insight into the fallacy of making emotions consist to a very considerable degree of organic activities. Had James not

[1] Psychol. Rev., 1894, 1, 516.

[2] Cf. Worcester, *Monist*, 3, 285 ff.

[3] Especially was this true, since as James himself realized, different organic activities may belong to the same emotions, Cf. Psychol. Rev., 1894, 1, 520.

been a subjectivist he would never have faced the necessity of making the organic processes into positive, adaptive responses which serve to express emotions. Rather he would have seen why the organic processes must inevitably be indifferent 'expressions' of emotions. Could James have seen that the organic processes are merely substitute activities which fill in a gap between two anticipatory or precurrent reactions, the former of which is not followed by an appropriate final act, he would have realized that these organic reactions could not be 'expressions' of specific 'emotions,' whether preceding or succeeding them. Failing to evaluate properly the organic resonances, James found in them nothing but an illusion of immediacy.

IV

Distinction of Emotions from Non-Emotional Feeling Behavior.—The strict observation of actual responses under different conditions of stimulation indicates very clearly that a wide difference exists between the disruptive types of emotional action and other forms of feeling behavior which are frequently called by the same name. Probably few accomplishments in psychology are more desirable than the isolation and examination of the distinguishing features of the great mass of activities which have been indiscriminately thrown into a heap through the intellectualistic influence of subjectivistic psychology. Let us note that the necessity to review the facts of affective behavior is intimately bound up with a naturalistic attitude. In the first place, not until such an attitude became at all established was it deemed necessary to give much attention to the detailed analysis of human behavior. Again, this naturalistic view is of extreme advantage for the study of feeling behavior, since it serves to prevent our being misled by the conception of a presumed operation in them of some form of common mental content symbolized by a word such as Fear or Anger.

In reply to the question whether there is any feature of behavior which sharply marks off the emotions from other kinds of feeling conduct, we may offer the tentative criterion of the presence or absence in the act of an organized response system. If this criterion be valid and if it be employed as a guide in the investigation of human activity, we ought to be able, not only to distinguish emotions from all other feeling behavior as a class, but also from each type of activity in the class.

Especially is it necessary to mark off sharply the emotions from the passions, which constitute a very different form of behavior. Unlike the emotions, the passions consist of organized response systems which in some form operate continuously, whether or not the original stimulating object is present. The passions, as exemplified by love and hate, are the prolonged functioning of organized response systems kept active by the periodic appearance of the original stimulus or by some substituted stimulus-object such as a letter or some other token. Moreover, between the intervals of direct or substituted stimulation by the original object of love or hate, the person is constantly responding in a characteristic feeling manner, thereby inducing much self-stimulation. Thus, a person who acquires a passion for another individual or some object such as books or music, begins to respond with some form of implicit feeling activity, becoming cheerful, hopeful, happy or enthusiastic, depending upon the specific circumstances.[1] Clearly, when we observe the person responding to the absent object of passion; that is, when he responds with the protracted implicit feeling activity, we cannot possibly confuse such behavior with the momentarily explosive emotional reaction. On the other hand, when we compare with an emotion the more violent focussed passion responses performed in the presence of the stimulating objects, probably the only crucial criterion is that the passion acts do, and the emotional acts do not involve definite organized reaction systems. However unsatisfactory the description of passion acts may be at the present time, it is beyond doubt

[1] The extreme importance of the situation to which responses are made is well brought out in these activities; also we observe the intermingling of different forms of feeling reaction in the same segment of behavior. Especially do we find considerable alternation between emotions and diffuse feelings.

that they constitute a genuine chapter in the psychology of feeling.

Also the emotions must be clearly distinguished from the sentiments which are in essence prescriptive and limiting types of activity developed under the influence of social approval. Sentiment acts are directed forms of responses usually resulting in some definite kind of complex social conduct. Illustrative of the sentiments are the activities of modesty, cleanliness, and charitableness. A sentiment is a preferred act of acquiescence or readiness to do certain definite complex things or to have them done. Again, sentiments are in a genuine sense latent and intermittent responses and the specific acts may involve much implicit or thought activity. As compared with sentiments, passions are for the largest part direct and specific responses to stimuli; passion acts being more elemental and explicit, they are also more closely integrated with the immediate surrounding conditions, while sentiments are more generalized reaction systems having a larger range of exciting stimuli.

Unfortunate indeed is the confusion of emotional conduct with diffuse feeling behavior, a practice generously indulged in when the term emotions is employed as a general blanket for all sorts of feeling activity. The diffused feeling acts are responses to prolonged conditions as of desire, achievement, or thwartedness. They are responses to objects and conditions definitely recognized as of a particular character, beautiful, good, wise, etc. Upon the basis of definite external situations in which the person finds himself we can trace out particular forms of responses that may be denoted regretful, remorseful, relief, elation, cheerful, enthusiastic, disappointed, admiring, patient, or impatient, happy, excited, shocked, depressed, and an indefinite number of others. In all these cases there are more or less continued effects brought about in a person through some contact with particular objects in specific settings. In each case it appears that the whole individual is involved, and for a considerable period of time; so that any particular feeling is distributed over all the reaction patterns of the person. In worry, for example, the individual seems overwhelmed by a certain environing condition and constantly keeps up a process of self-stimulation, thereby reinforcing the feeling. We find also the constant tendency to hark back to the feeling stimulus as a point of reference. Thus when we are worried about an impending calamity and read of someone's success, we connect ourselves with that situation and feel deeper concerning our own affair. In a general way, the diffuse feelings are implicit phases of all the activities of the person while he is in an affective condition.

Since the diffuse feelings are not outwardly directed, the definite response systems of such behavior are not always manifest to the observer; so that it may not be entirely out of the way to say that in intense feeling one is simply acting upon oneself. As a consequence, to a considerable extent we may think of diffuse feelings as conditioning activities, in the sense that while they are operating they will affect any activity the person is performing.

Great as are the difficulties of description encountered in even the slightest penetration into the maze of feeling responses, they can be amply accounted for by the lack of exploration in the psychology of feelings. The absence of accurate investigations in this domain is manifested by the fact that the interpretation of feeling conduct is based less upon facts of concrete reactions than upon the habits of popular speech. The futility of such interpretation is clear when we consider that no feeling term in popular use refers to a type of response belonging exclusively to a single class of psychological reaction. But although we have yet to begin the isolation of the various classes of feeling behavior, the differentiation of emotional conduct from the various other forms of feeling behavior appears plausible and worth while.

V

Are Emotions Inherited?—The conception of emotions as inherited forms of response is a legacy which psychology has acquired from the tradition of biological abstractionism.[1]

[1] Cf. Kantor, 'A Functional Interpretation of Human Instincts,' Psychol. Rev., 1920, 27, 55.

Immediately we face the question as to *what* is inherited and *how*. From the standpoint of a mental states psychology, one might say, of course, that a permanent state of mind may be inherited, but what bearing can such an assertion have upon the problems of objective psychology? When we confine our study to definite facts of behavior and reject the conception of emotion-cause and its manifestations, we find no specific kind of chaotic condition as a permanent acquisition of the person, arousable to action by various sorts of stimulating objects or conditions. Some there are who might say that the inheritance of emotions means that the individual is so constituted that he will suffer dissociation when put under certain kinds of stress, but how informing is this statement? Such a statement is on a par with the assertion that the human individual is born to think, to perceive, to wear clothes, as well as to undergo various other experiences.

The doctrine of diuturnal inheritable emotions must inevitably make emotions into entities of some sort. For, consider that the doctrine requires nothing less than that a person should be equipped with some innate powers manifesting themselves in complex and peculiar activities in emotional situations. Not the least objectionable consequence of the entity interpretation is that it implies a parallelism or an interactionism, and this circumstance always means an obscuring of the actual events in human behavior. An emotion comes to be either a cause, an effect or an accompaniment of bodily activities.

That much of the writing concerning emotions is based on an entitative conception is amply demonstrated by the psychological literature relative to the organization, combination and association of emotions. Thus, from the time of Descartes to the present, there is an unbroken procession of theories as to how a few primary or simple emotions (states or entities) become combined into complex emotions or sentiments. The only difference between a seventeenth century mixture and a twentieth century compounding of emotional states lies in the connection of the emotion in the latter case with an instinct which is presumed to be in some sense a biological process.[1] In actual practice, however, there is little difference between Descartes' organization of all emotions (passions) he enumerates forty from the six primaries (admiration, love, hatred, desire, joy, and sadness) and Spinoza's combination of all (about forty-six)[2] from the three primaries (desire, pleasure, and pain) or McDougall's, Shand's and Ribot's association of elementary emotional states into complex sentiments. In all cases there is a logical grouping of elements which are apparently derived from an analysis of feeling situations[3] quite after the fashion of the British associationists. In no case is there, nor indeed can there be any attempt to connect such combinations of emotions with any directly observable data of behavior.

At the basis of all intellectualistic attempts to describe and compound emotions lies the assumption explicit or implied that the psychologist is attempting to describe the ultimate character of human nature and not the concrete behavior of a human organism under its various conditions of stimulation. This assumption of the ultimacy of human nature further implies that emotional states constitute some of the prominent factors of human nature. Here is a suggestion as to the motive for assuming the inheritability and permanence of emotions, namely, a prejudice concerning the absolutistic and invariable character of psychological facts. The domain of psychology appears to be the final halting place for those finalities which, since the Renaissance, have been gradually ousted from the natural sciences. Instead of describing emotional behavior, as indeed all other phenomena of the psychological domain, as definite organismic responses to specific stimulating circumstances, the attempt is made to describe behavior as manifestations of putative powers, or substances resident in the individual. In consequence, the names of emotions, as well as other classes of behavior are hypostatized

[1] We use the term biological process here because, while even in Spinoza we find a reference of emotions to biological conditions, such reference does not involve specific modern physiological details.

[2] I adopt Ribot's calculations here.

[3] "We may count as primitive all those which cannot be reduced to previous manifestations." Ribot, 'Psychology of the Emotions,' p. 13.

into unique qualities of mind. The subjectivistic psychologist of emotions treats the behavior he studies much after the fashion in which the older ethicist handled the social activities he dealt with, and so fear, love and anger became 'properties' of the individual in a manner similar to that of the 'virtues.'

If anything can be clearly made out in the observation and description of emotional behavior it is this: that such behavior only occurs under definite, external surrounding conditions and therefore can only be described in terms of such conditions. The specific movements of and changes in the individual are direct effects of definite external circumstances and not expressions of innate and continuous entities. This fact is, of course, no more true for emotions than for any other sort of behavior, but it requires special mention here, because the tradition has grown up that emotions are peculiar forces or tendencies which manifest themselves in many singular ways. This is in effect making emotions or the instincts which are presumed to operate with them into final causes or primary principles of behavior of which the various activities of the human individual are the effects.

Excellently illustrative of this attitude is the reiterated assertion that love in all its forms, including all the acts referred to under this term, is the manifestation of a hidden force called the sexual instinct. This sex-love situation admittedly constitutes a crucial instance because of the pervasiveness of sex behavior, but a critical examination of the facts involved offers sufficient evidence that every specific activity which we find in this series of behavior segments can be described without invoking any transexperiential causative factor. The wide prevalence and constant occurrence of certain forms of behavior can be readily accounted for on the basis of incessant stimulation. Consequently, it would be very remarkable if there existed less sex activity in the form of actual sex behavior and discussion than we now find in the presence of all the multifarious sex stimulations, both social and physiological, constantly surrounding us.

Among the conditions unwittingly designed to induce sex stimulation are the divergent apparel, work, duties, virtues of men and women, which have developed with an uncanny inclination towards the emphasis of sexual differences. Moreover, modern civilization has tended more and more to make of woman a sex object, a stimulus to sex reaction. Possibly the reader will find just here a justification of the belief that a sex instinct-emotion is responsible for such social development as we have suggested; but is it of advantage to psychology, we might ask, to compromise our interpretations with a hopeless bias of immutable final causes, in view of the fact that we can readily convince ourselves of the existence of definite empirical facts to account for the kind of society that we have developed? Any critical investigation of differential phases of civilization as represented by different geographical, national and temporal conditions, will disclose sufficient economic, social, and religious motives, in short, verifiable conditions, to account for the peculiarities of our complex social behavior.

And now we must consider the biological facts of sex, those most potent sources of confusion in psychological investigations. Because the biological factors which condition psychological reactions are so imperious in their influence and so constant in their operation they have been repeatedly misinterpreted. Instead of being described as essential factors in organismic reactions they have been made into vital forces or purposes. Now obviously the biological organization of the person as the pre-psychological matrix of all human behavior, exerts great influence upon his conduct, but just as obvious it is that the biological sex factors are simple stimulus-response activities. To consider the comparatively simple biochemical processes which operate as components in psychological reactions as causes or representatives of vital causes is to do violence to critical observation. Furthermore, it is not incorrect to say that the biological factors of sex, at the level of human psychological development, serve as subordinate influences of behavior among the exceedingly many others. Are we beyond understanding how physiological sex activity can be secondary excitements to behavior originally induced by primary social sex stimulation? And what of the numerous sex-gland and other reflexes which serve as important stimuli to sex behavior, both implicit and overt? Are these reflexes to be interpreted as anything but natural consequences of the metabolic conditions of the individual at the time? For if they are the results of such definite physiological processes, and who can doubt the fact, then they are, of course, the effects of immediately occurring and verifiable biological processes, and not the manifestations of mysterious instincts. Most infelicitous is the confusion of the directly observable biological processes stimulating us to action, precisely as the other conditions about us do, with hidden forces which have no actual existence aside from their name. Must we not conclude then, that the biological factors of sex, in the form of sex structures and their functions, merely provide a foundation and a means for the operation of sex behavior, while the sex reflexes serve only as concrete stimuli for various kinds of reactions?

To believe that all the complex human sex actions are the manifestations of a sex-instinct-emotion is like attributing the standing-up reactions of a child to an upright instinct, although in the latter case only the slightest amount of critical observation makes it easy to see that it is not because he has a standing-up instinct that the child is induced to acquire standing-up reactions, but because in addition to his peculiar biological structure he is living in a standing-up world. All the objects and their settings are standing-up objects and it would be really impossible for the child to develop otherwise. Here as elsewhere, of course, one can invoke an absolute teleological factor and say that an ultimate cosmic purpose has brought it about that the child should be born into a standing-up world. The writer frankly admits that to such an argument he lacks all answer.

If we have succeeded in making it at all plausible that the intricate emotional and feeling behavior of a sex character is to be interpreted primarily, if not exclusively, in terms of definite surrounding circumstances, it must appear that the same situation would be true in the case of other feeling behavior such as anger, grief, and fear. In each case, the specific phases of the behavior event can be correlated with a stimulating object or condition. The names given to the events denote concretely occurring phenomena and not ends which are being worked out through pre-arranged machinery. Unfortunately psychologists have been in the habit of considering emotional responses as innate feeling activities much after the fashion in which they have thought of instincts as innate knowledge processes. And this condition prevails in spite of the fact that every observation of fear or anger behavior strongly suggests that no matter what action occurs, it is a direct function, in a mathematical sense, of changes that are taking place in the environment of the individual. What is more natural than that one should attempt to strike back when struck, and when this is prevented by holding the hands it is to be expected that the person will kick, cry, and attempt other means of releasing himself and doing damage to his opponent. This whole activity may be called an anger stimulus and response situation, but in no sense must we speak of the striking out, the breath holding, the snarling and the crying as 'emotional manifestations' of an anger 'emotion.' Can there be any other explanation than that the variable and unpredictable occurrences in an emotional situation are the results of series of specific external stimulations? As to the name of the total behavior when the name stands for an actual emotion, is not that derived from the mere fact that it includes an emotional factor, although that factor is of the briefest duration. For the most part, however, the actions taking place in the total situation can be analyzed into volitions, habits, perceptual responses, etc. Do psychologists mean by an 'emotion' anything more than some event hypostatized through the medium of a name?

(To be concluded.)

THE AFFECTIVE TONE OF LINES: EXPERIMENTAL RESEARCHES[1]

BY HELGE LUNDHOLM

Literature about Art very often gives us descriptions of masterpieces, wherein pure lines are characterized by adjectives that indicate a more or less emotional quality. Thus authors used to write about melancholy lines in paintings by Perugino, quiet lines in certain classical schools, violent lines in the barocque art, etc. Out of these facts there arises a problem. Is the affective character of the line a quality which is bound to the line itself, or is it suggested by the literary subject of the masterpiece? Furthermore, is this quality a phenomenon that appears equally to different observers? In order to throw light upon these questions, the following experiments were undertaken. The procedure was very simple. The persons who acted as subjects were asked to draw lines, each of which was to express the affective tone of an adjective given verbally. In the first series 48 adjectives, divided into 13 groups of synonyms, were used as follows:

I. Sad, melancholy, mournful, doleful, sorrowful.
II. Quiet, calm, tranquil, serene.
III. Lazy, indolent, idle.
IV. Merry, cheerful, gay, jolly, joyous.
V. Agitating, exciting, sprightly, fiery, brisk, vivacious, lively.
VI. Furious, angry, cross, vexed, enraged.
VII. Dead, dull.
VIII. Playful.
IX. Weak, feeble, faint, delicate.
X. Gentle, mild.
XI. Hard, harsh, cruel.
XII. Serious, solemn, grave, earnest.
XIII. Powerful, forceful, strong.

[1] From the Psychological Laboratory of Harvard University, 1919–1920.

Two other series followed: the first of these was to find out if certain lines, so to speak, accord with certain colors; the second to learn what is characteristic of purely beautiful lines. The adjectives of these series were:

XIV. Red, blue.

XV. Beautiful, ugly.

Each line was drawn with a pencil on a sheet of white paper, 21 × 27 cm. in size. The greatest liberty was allowed the subjects even with regard to the time used in drawing the lines. The manner of moving the hand and pencil while drawing was carefully observed and described in each individual case. No record was taken either of the pressure of the pencil or of the time used in drawing each line. The series were repeated, the only change in the instruction being that the line should be drawn as rapidly as possible. The first and second line of each type were compared and if they differed the subject was requested to draw a new one, after which he decided which of the lines most satisfactorily expressed the purport of the adjective in question. It sometimes happened in the first series, that a subject drew several lines of one and the same type as if for trial. In those cases too they decided themselves which line satisfied them most fully. In tabulating the results only one line of each type was used and then always the one which had been judged most expressive.

The subjects were requested to express the adjective as far as possible by a pure line, not to symbolize sadness by the curve of a melancholy mouth or strength by a line suggesting the contour of a rock-formation, etc. Yet they were earnestly instructed to mention associations of this nature. Furthermore they were requested to describe the relation of every synonym to the first adjective in the group, in order that the experimentor might know what meaning the subject attached to the various adjectives. The introspection was carefully noted, and as far as possible verbatim. The sequence of the lines was such that two lines belonging to the same group never followed each other and were very seldom drawn in the same period.

The subjects were eight in number: four women, G, L, Mi, S; and four men, C, D, F and Ma. No one of them was either painter, or designer, nor did they know anything about the theories of the æsthetics of lines.

The experimentation took place from October 1919 to May 1920 in the Psychological Laboratory of Harvard University.

When the experiments were finished an examination of the results revealed certain principles by which the lines with a few exceptions could be classified. Thus they could first be separated into the following groups:

I. Lines with only curves.
II. Lines with only angles.
III. Lines with both angles and curves.

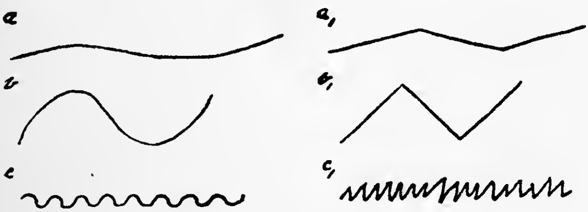

FIG. 1.

The first group (I) could in turn be divided into three subdivisions:

(1) Lines with a few long and low waves (Fig. 1, *a*).
(2) Lines with a few high waves of medium length (Fig. 1, *b*).
(3) Lines with numerous small waves of varying shape (Fig. 1, *c*).

Correspondingly the second group (II) could be subdivided into:

(1) Lines with a few obtuse angles (Fig. 1, a_1).
(2) Lines with a few approximate right angles (Fig. 1, b_1).
(3) Lines with numerous acute angles (Fig. 1, c_1).

Finally the third group (III) could be subdivided according to the way in which waves of type *a*, *b*, and *c* were present in combination with angles of type a_1, b_1, and c_1.

Another point of view from which the lines could be classified was that concerning their general direction. They were supposed to be drawn horizontally from left to right in the largest dimension of the paper. Nevertheless in some of them there was a marked tendency to run upwards, in others a tendency to run downwards. These two together with the horizontal direction gives us three more groups.

It is self-evident that a classification of such a great number of lines as the experiments produced, must always be, to a certain extent, approximate. As has already been said the small waves were very often of a varying shape, and this variation grew still greater when they occurred in combination with angles. The latter in turn, especially acute angles, also showed very varying forms. Likewise there were found intermediate forms which were placed in the system according to the degree with which they approached the main types. It was easier to group those lines which had long and low waves and obtuse angles. Waves of type *a* very seldom occurred together with waves of type *c* in one and the same line. In a few cases waves of the latter type were found mixed with those of type *b*. In such cases the lines were placed within sub-group (2) or (3) according to the frequency of the different waves. Quite analogous was the situation regarding the occurrence of angles of the types a_1, b_1, and c_1.

The long and low waves and the waves of medium length were very few in number in each line, as a rule there were only 1½ or 2 of them; while the small waves were numerous, in most cases 15 or 20. In the same way the obtuse and right angles always occurred less frequently than the acute ones. Sometimes small waves and acute angles were found as a secondary oscillation of a long wave or of a wave of medium length. This was often the case when the main direction of a line had an upward or downward tendency. Since in such cases the introspection did not attribute any other importance to the main wave than that of indicating upward or downward movement, these lines were always grouped under the type of small waves and acute angles.

On the following pages the lines are tabulated according to the two points of view mentioned. The headings of the

Table I.

	A			*C*			*A* and *C*						*Di*		
							A			*C*					
	B	*M*	*S*	*B*	*M*	*S*	*B*	*M*	*S*	*B*	*M*	*S*	*H*	*U*	*D*
I.															
(*a*) Sad........				7	1								2		6
(*b*) Melancholy.				7	1								1		7
(*c*) Mournful...				6	1	1							1		7
(*d*) Doleful.....				5	1				1			1	1		6 Ma°
(*e*) Sorrowful...				7		1								1	7
Total.....				32	4	2			1			1	5	1	33
II.															
(*a*) Quiet.......				8									7		1
(*b*) Calm.......				8									5		3
(*c*) Tranquil....				8									6	1	1
(*d*) Serene......				8									8		
Total.....				32									26	1	5
III.															
(*a*) Lazy.......				8									1		7
(*b*) Indolent....				7	1								3		5
(*c*) Idle........				7									3	1	3 C°
Total.....				22	1								7	1	15
IV.															
(*a*) Merry......						6			2		2		4	4	
(*b*) Cheerful....				2	1	3		1	1	1	1		3	5	
(*c*) Gay........					1	5	1		1	1	1		3	5	
(*d*) Jolly.......					3	3			2		2		5	3	
(*e*) Joyous.....				1	2	3			2		2		1	6	1
Total.....				3	7	20	1	1	8	2	8		16	23	1
V.															
(*a*) Agitating...		3							5		5		4	2	2
(*b*) Exciting....				1		2			5		5		3	5	
(*c*) Sprightly...						2			6		6		7	1	
(*d*) Fiery.......		3							5		5		5	2	1
(*e*) Brisk.......		2						1	5	1	5		4	4	
(*f*) Vivacious...					1				6	1	5		2	6	Ma
(*g*) Lively......									7	1	6		4	3	1 Ma
Total.....		8		1	1	4		1	39	3	37		29	23	4
VI.															
(*a*) Furious.....			2						6		1	5	4	3	1
(*b*) Angry......			1						6			6	4	2	1 S
(*c*) Cross.......			2	1					4		1	3	3	2	2 G°
(*d*) Vexed......			2				1	1	4		1	5	3	4	
(*e*) Enraged....			1			1			5			5	3	4	1 D
Total.....			8	1		1	1	1	25		3	24	17	15	5

	A			*C*			*A* and *C*						*Di*		
							A			*C*					
	B	*M*	*S*	*B*	*M*	*S*	*B*	*M*	*S*	*B*	*M*	*S*	*H*	*U*	*D*
VII.															
(*a*) Dead.......		1		5									7		1 D.L.
(*b*) Dull........	1			6									5		3 D.
Total.....	1	1		11									12		4
VIII.															
(*a*) Playful.....					1	2			4			4	3	4	1 S
IX.															
(*a*) Weak......				4		4							3		5
(*b*) Feeble......				3									3	1	4 Mi, L, C, G, Ma.
(*c*) Faint........				5	1								3		5 S.F.
(*d*) Delicate....				1	1	4			1			1	5	2	1 Ma.
Total.....				13	2	8			1			1	14	3	15
X.															
(*a*) Gentle......				7		1							5		3
(*b*) Mild.......				5	1	1							7		1 Ma
Total.....				12	1	2							12		4
XI.															
(*a*) Hard.......	1	5	2										6	1	1
(*b*) Harsh......			4						4		1	3	3	1	2 Ma, S.
(*c*) Cruel.......		1	5		1				1			1	4	2	2
Total.....	1	6	11		1				5		1	4	13	4	5
XII.															
(*a*) Serious.....				5	3								4	1	3
(*b*) Solemn.....				6		1							5		3 Ma
(*c*) Grave......				6	2								3	1	4
(*d*) Earnest.....				5	1									4	4 S Ma
Total.....				22	6	1							12	6	14
XIII.															
(*a*) Powerful....		1		3	4								5	3	
(*b*) Forceful....	1	2	1	2	1				1			1	3	4	1
(*c*) Strong......		2		1	4	1							1	5	2
Total.....	1	5	1	6	9	1			1			1	9	12	3

columns mean: (*A*) angles, and (*C*) curves, (*B*), (*M*), and (*S*), big, medium, small, referring respectively to waves of the types Fig. 1, *a*, *b*, and *c*, and angles of the types Fig. 1, a_1, b_1, and c_1. (*Di*) means chief direction, (*H*), (*U*), and (*D*), horizontal, upward tendency and downward tendency. On the right side of each table are indicated lines which for one reason or another are outside of the groups. The letters at the right indicate the subjects who draw those unclassified lines, while the horizontal line in which they stand indicate the type of the line (sad, joyous, etc.). A letter with index ° means that the line was not drawn by the subject.

Table II. shows how the lines are divided if each group of synonyms is taken as a whole. The numbers are reduced to a per cent. of the total number, within the group.

TABLE II.

	A			*C*			*A* and *C*						*Di*			
							A			*C*						
	B	*M*	*S*	*B*	*M*	*S*	*B*	*M*	*S*	*B*	*M*	*S*	*H*	*U*	*D*	
I. Sad, etc.				82	10	5			3			3	13	3	84	
II. Quiet, etc.				100									81	3	16	
III. Lazy, etc.				92									29	4	63	4
IV. Merry, etc.				8.4	18	50	2	2	20		4	20	40	58	2	
V. Agitating, etc.			14	2	2	7		2	70		5	67	52	41	7	3
VI. Furious, etc.			21	2.5		2.5	2.5	2.5	64		8	61	44	38	13	5
VII. Dead, etc.	6	6		69									75		25	19
VIII. Playful					13	26			50			50	38	50	12	11
IX. Weak, etc.				41	6	25			3			3	44	9	47	25
X. Gentle, etc.				75	6	13							75		25	6
XI. Hard, etc.	4	25	46		4				21		4	17	54	17	21	8
XII. Serious, etc.				69	19	3							38	18	44	9
XIII. Powerful, etc.	4	21	4	25	38	4			4			4	37	50	13	

If, to begin with, we look over the first six groups in the tables we find that in group I.–III. (sad, quiet, lazy, etc.) most of the lines show curves of type *a*, *i.e.*, 82 per cent., 100 per cent. and 92 per cent., while the number of lines drawn with small curves, and with angles and curves is very inconsiderable. In the groups IV.–VI. (merry, agitating, furious, etc.), which contain adjectives indicating to a certain extent opposite mental states, the contrary is true, that is, a very great number of lines show short waves and acute angles while waves of types *a* and *b*, and angles of a_1 and b_1, are a decided minority. It is also striking that in Group IV. (merry, etc.) lines with only short waves of type *c* predominate and that in Group V. (agitating, etc.) we meet for the first time lines with only angles, and those all of type c_1.

Hence we find a relative uniformity in the lines belonging to groups I.–III. (sad, quiet, lazy, etc.) as well as a certain uniformity in the lines of groups IV.–VI.(merry, agitating, furious, etc.). If we compare these facts with the qualities suggested by the corresponding adjectives we find that all those adjectives indicating a state of mind of little motor expression (groups I.-III.) have been symbolized by lines consisting chiefly of long and low waves, while those which indicate states of strong motor expression have been symbolized by lines of either short waves alone, or acute angles alone, or of both. This result can be illustrated by the following formula, in which *m* means states of mind with little, *M* with strong, motor expression and the other letters refer to the different types of waves and angles already described.

$$\text{I.}\quad m = a \qquad\qquad \text{II.}\quad M = \begin{cases} c \\ c_1 \\ c + c_1 \end{cases}$$

It has long been known that pure lines in themselves are able to suggest movements or motor states. Consequently the question arises whether there is a law for these phenomena; that is, whether certain lines suggest movement in a higher degree than others. An answer to this question was obtained by the following simple experiments. Each of the subjects was asked to draw four wave lines suggesting movements of different degrees of intensity.[1] They all drew them alike. The line of least movement had long waves of type *a*, the next had shorter waves, and compared with the length, higher waves, the third had still shorter waves and the fourth small waves of about the same type as *c*. It is to be remarked that in the last line the waves were frequently sharpened and approached acute angles. These experiments show, undoubtedly, that long and low waves suggest less movement than shorter and higher ones, and furthermore that the movement suggested by a line becomes accentuated if this contains acute angles. Several introspective statements of the subjects verify these results. A few of them follow:

[1] By intensity is meant both rapidity and the force which is read into the line.

G: There is often much movement in an angular line but this movement is of a jagged, broken, and hard character.

L: Small waves make the movement of a line go more quickly. The calm line has slow, long curves.

Mi: Sharp angles give a sensation of speed—much action. Broad curves represent more enduring emotions, while the small curves show more transitory and volatile emotions. They are more rapid.

C: Angularity of a line expresses violence of movement. If a curve is slowly undulating or sweeping it is soft. To be so, it must have long waves with low amplitude. Angles and straight lines always express violence, energy of movement. A long curve always expresses slowness.

F: Angles, especially the sharp ones, express vivacity. Short curves imply vivacity.

Many more statements of the same nature could be quoted, but those already chosen are sufficient, especially since there is not a single contradiction.

Hence we see first that lines symbolizing states of strong motor expression have short waves and acute angles and lines symbolizing states of weak motor expression have long and low waves; and second that lines with waves of the former type and acute angles themselves suggest intense motion, while lines with waves of the latter type suggest weak and slow motion. This justifies us in supposing that the affective character of lines has its origin in the suggestion of movement of the line that it depends upon the idea that this movement in some way imitates the motor expression of an emotion. This supposition becomes greatly strengthened by the fact that the subjects themselves have mentioned the movement as being of importance for the emotional expression of the lines.

How the illusion of movement itself in the pure line arises, is another problem which has been treated to a great extent in psychological literature. The only light that was thrown upon the theory of the phenomenon by the subjects was, that three of them agreed in explaining that the suggestion of movement of lines was connected with an idea of the motion of the hand in drawing them. One of the subjects connected the phenomenon with the movement of the eye in following the line; the rest did not express any opinion.

If we compare groups IV. (merry, etc.) and VI. (furious, etc.) in the tables, we find that in the former 50 per cent. of the lines show only small waves, and 20 per cent. show small waves and acute angles, while in the latter only 2.5 per cent. show small waves, and 64 per cent. small waves and acute angles. There is an obvious difference between the two groups, although both of their adjectives indicate states of strong motor expression. We obtain the explanation of this, however, if we examine the general introspective statements regarding the feeling tone of curves and angles, which were given during the progress of the experiments. A complete and systematical quotation of them follows:

G: Sharp angles are unpleasant—weakness can never be expressed through angles. The rapid interruption through angles gives the impression of furiosity. Angularity of a line suggests sharpness, impatience, hard-heartedness, a certain unfeeling vigor and strength. Likewise angularity implies absence of gentleness and grace. Very little refinement can be suggested by it. There is often very much movement in it, but of a jagged, broken and hard sort. It lacks high purposes; it is an unstudied line of least resistance.

Curves suggest grace, serenity and most of those physical and mental qualities acquired in civilization and education. The curving of a line gives it more maturity, it gives the poise and refinement of nature. It does not lack strength, it always expresses a high and rather moral quality of a feeling.

L: Sharp angles hurt. Angularity expresses the hard, angry, and unpleasant emotions. It indicates fire, storm, strength and power.

Curves denote grace and beauty, serenity and kindness. The finer characteristics of all elements are shown by curves. Big curves express graveness, firmness and strength.

Mi: Small angles are cruel because they remind one of stabbing points. Angularity of a line usually expresses ungracefulness, too much expenditure of energy for the execution of the intended movement. Much action. Suggests the emotion of anger, fear, surprise, excitement, all emotions which are sudden and immediate. Also expresses pain, anguish, brutality and sharpness. Obtuse angles represent emotions of a slower, less emphatic sort; sharp angles give a sensation of speed and deeper excitement and a higher point of emotional instability.

A curving line usually represents grace and economy of movement. It is pleasanter than an angular line, because it does not take so much trouble to follow it. It suggests gentle emotions, such as pleasure, happiness, gaiety, and the opposite sorrow and grief. Broad curves are more graceful than small curves and represent more enduring emotions, while the small curves show more transitory and volatile emotions. Power is expressed in big curves, even dignity.

S: Angularity means awkwardness and hardness, lack of gracefulness in the movement. I do not think a right angle could ever be soft. Could not connect an angular line with gentleness, because it is hard and sharp.

Curving of a line means sweeping motion. Anything curved, going very slowly, is mild.

C: Angles give the idea of violence and vivaciousness; they imply viciousness, anger, etc. There is a correlation between straight lines and angles, and hardness.

A long curve always expresses smoothness and slowness. Lines curving upwards express increase of *tonus,* lines curving downwards express relaxation—sometimes depression. A curve is soft if it has long, low waves which undulate in a smooth way.

D: Harshness must always be expressed with angles. The weak line has not energy enough to make angles. Angles express the absence of conscious idea., Angles in a line imply the more abrupt and violent emotional states. They represent feelings that are more or less spasmodic in expression with no special inhibition of a tendency towards marked accent. Angles are harsh and consequently striking. Angles, on the whole, express the more intense, elementary feelings.

In contrast to angles, curves in a line usually represent the more refined and purely intellectual feelings. They tend to modify and control even the most violent of emotional states and consequently are usually the more pleasing of the two. Curves also tend towards a more intimate coördination between the different elements expressed in a feeling state; and hence aid in uniform and consistent expression of any particular state or states. Curves appeal to the finer and more highly differentiated aspect of the subject.

F: Angular motion represents hard and painful feelings. Angles even tend to express strength, vivacity—sharp angles, distress; broader angles, power, determination, calmness.

Curves express grace and are usually pleasant. Short curves, grace and liveliness; long curves, beauty, indolence, calmness. Curves in general express the weaker and less forceful emotions.

Ma: Sharp angles imply the idea of pain, pricking pain, spitefulness, incongruity, instability, moodiness. Angles even imply sharpness and sudden transition, brusqueness, caustic feeling, quick temper, ugliness.

Curves imply gradual transition, the more subtle emotions, prettiness, lack of much strength, smoothness.

With the above-quoted introspection as a back-ground we can easily understand the difference in character of the lines belonging to groups IV. (merry, etc.) and VI. (furious, etc.); it is the general pleasantness of the emotions in the former group which has caused the subjects to symbolize these emotions with chiefly curved lines, while it is the unpleasant and unrefined feeling tone of the emotions in the latter group, that underlies the use of so many angles in its lines. We can likewise understand the distribution of angles and curves in groups IX. (weak, etc.) and X. (gentle, etc.) on one hand and in group XI. (hard, etc.) on the other. In the first two of these groups the curves are in a decided majority (72 per cent. and 94 per cent.) and in the latter the angles (75 per cent.) and the angles and curves (21 per cent.). The reason for the long and low waves predominating in groups IX. and X. is without doubt that the state indicated has a weak motor expression, while the reason for the predominance of acute angles in group XI. is due to the more painful feeling tone connected with the character of the states expressed through its adjectives.

If we compare groups IX. (weak, etc.) and XIII. (powerful, etc.) which are opposite in regard to the meaning of their adjectives, it will be noticed that in the former, curves of type *b* are in a decided minority while in the latter, the same curves together with angles of type b_1 tend to predominate. These groups consequently show first in a negative and secondly in a positive sense, that high curves of medium length are the ones which above others suggest strength. Group XIII. also seems to imply that the right angles of type b_1 possess the same quality. A few introspective statements already quoted in another connection verify this.

L: Big curves express graveness, firmness, and strength.
Mi: Power is expressed in big curves, even dignity.
S: I do not think a right angle could ever be soft.
F: Broader (in opposition to sharp) angles represent power.

Finally if we examine those groups not yet treated, VII. (dead, etc.) VIII. (playful) and XII. (serious, etc.), we can easily interpret their lines from the points of view which we have already gained. VII. and XII. contain chiefly waves of type *a* (69 per cent. and 69 per cent.), obviously depending upon the inactive character of their adjectives; VIII., on the other hand, the more active group, contains chiefly waves and angles of types *c* and c_1 (50 per cent.) or waves of type *c* only (26 per cent.). Perhaps we should have expected the last number to be a little larger considering the pleasant feeling tone of the state.

Those lines which differ too widely from our categories to be subordinated to any one of them, show few traits of interest. As a rule their shapes have been fixed by one or another concrete association. In only a few cases can the deviating lines be said to form a category of their own, as for instance in group VII. (dead, etc.), where they are all horizontal straight lines, or in group IX. (weak, etc.), where a common quality in seven of them is that they are each drawn with a consciously trembling hand. The association lying behind this is too obvious to need any description. That straight horizontal lines have been used as symbols for death and dullness has, according to the statements of the subjects themselves, its cause in their lack of motion.

Before we proceed further it mght be useful to incorporate some of the new results in the formulæ which we have already drawn up. This can be done by dividing the second of them into two new ones. Thus:

$$\text{III.} \qquad Mp = \begin{cases} c \\ c_1 \\ c + c_1 \end{cases} \qquad c > c_1$$

$$Mu = \begin{cases} c \\ c_1 \\ c + c_1 \end{cases} \qquad c_1 > c$$

Mp means an emotion with strong motor expression and pleasant feeling tone. *Mu* an emotion with strong motor expression and unpleasant feeling tone. $>$ means more frequent than.

As already stated, the lines could also be divided into groups according to their chief direction, which is recorded in the last columns of the tables. In regard to these also, general tendencies can be established.

If we begin by giving our attention to groups I. (sad, etc.) and IV. (merry, etc.) we find that in the former 13 per cent. of the lines are horizontal, 3 per cent. inclining upwards and 84 per cent. inclining downwards, while in the latter 40 per cent. are horizontal, 58 per cent. inclining upwards and only 2 per cent. inclining downwards. The explanation is given by the introspection of the subjects, in the following statements:

The downward tendency of a line expresses relaxation, the upward expresses power. The downward tendency expresses faintness, not sufficient strength to keep up. Going downwards expresses losing of energy. The doleful line droops without energy. If it had force it would have ascended higher. Strength is expressed by going upwards. A joyous line also ascends. Joy is an uplifting feeling. A forceful line tends upwards. Thereby it obtains the idea of ambition. A line indicating strength is a line tending upwards, never downwards.

On not less than 57 different occasions analogous statements have been noted, and not a single one shows a tendency towards an opposite opinion.

Therefore it seems to be obvious that even the direction of the lines to a certain extent imitates the motor expression of an emotional state and that consequently the direction is one of the factors that partakes in giving them their affective tone. Direction upwards expresses strength, energy, force, ambition, uplifting feelings, etc., direction downwards, weakness, lack of energy, relaxation, depression, etc.

If we look over the different groups with attention to their chief direction, this is verified. In the groups IV., V., VI., VIII. and XIII. containing synonyms for merry, agitating, furious, playful, and powerful we find more upward than downward tending lines, while in I., II., III., VII., IX., X., XI. and XII. groups, containing synonyms for sad, quiet, lazy, dead, weak, gentle, hard, and serious, a larger number of lines tends downwards than upwards. All these facts correspond to the general differences in the emotional states so far as the qualities just mentioned are concerned.

It is interesting to note that in group II. (quiet and its synonyms) namely the indifferent group, the largest per cent. (81 per cent.) of the lines tends towards the horizontal. Why group XI. (hard and its synonyms) has more downward than upward-tending lines can not be explained through the introspection directly. The differences in per cent. (21 per cent. to 17 per cent.) is small enough, however, to make it possible that it may be due to chance.

The experiments were not carried on in such a way that they gave exact records either of the fashion in which the lines were drawn, or the time used in drawing them. Investigations concerning these could be undertaken and should give interesting results. Judging from the observations made by the experimenter a tendency seems to exist to draw the more rapidly, the stronger the motor expression of the state of mind to be symbolized is. Thus as a rule the joyous lines were drawn much more rapidly than the sad ones. Likewise the small waves and the acute angles were generally drawn more rapidly than the big waves and the broad angles. There were exceptions, as for instance when cheerfulness was expressed through one single big upward-going half wave, drawn with great rapidity, or when excitement was expressed in an analogous way. Even the thickness of the line and the pressure of the pencil seemed to follow certain rules. Strength was very often expressed by a homogeneous thickness of the line caused by a strong continuous pressure of the hand when drawing. We have several similar introspective statements. Breadth of a line gives the impression of strength. It expresses intensity, strength and great saturation.

On the contrary, lines belonging to the group of "weak" and its synonyms are drawn as a rule so thinly that at times they can hardly be seen. One of the subjects even defined a weak line as a line that "you hardly can see." Such observations indicate that further experiments aiming to record the rate and manner of drawing the lines would be worth while.

As has already been said, the subjects were requested to avoid concrete associations as much as possible, but at the same time to mention if they happened to appear. Few associations have been noted. This, however, does not exclude the fact that such did influence unconsciously the shape of the lines, and their feeling-tone. The following is a complete record of all associations written down in the subjects' own words:

G: Sad: drooping lips, gloomy valley pits. Indolent: picturesque laziness of southern people, vagabond. Merry: childish quality, like jumping. Jolly: like a kitten. Joyous: bumping movement like a ball; a boy turning somersaults. Vivacious: harlequin. Fiery: dragon. Playful: a cat playing with a ball. Hard: undecorated wall. Strengthful: pyramids and mountains.

L: Cheerful: something rippling. Joyous: dancing. Furious: sharp points that hurt.

Mi: Merry: the country, jumping. Fiery: flames in a fire. Weak: a weak chin. Hard: saw teeth. Powerful: buildings and big waves.

S: Melancholy: a weeping willow tree. Doleful: a doleful face. Merry: making noise. Joyous: child clapping its hands.

C: Indolent: a yawn. Merry: dance. Furious: lightning; musical associations. Sprightly: movements of a danseuse.

D: Fiery: lightning.

F: Idle: idea of walking around. Vexed: angles represent a hard and painful feeling.

Ma: Sad: a man suddenly starting up and then relaxing. Lazy: the general outline of a slope. Idle: a man doing nothing. Merry: turning round, jumping. Cheerful: dancing. Dull: a dull knife. Weak: a weak mouth. Hard: the rock of Gibraltar. Serene: the idea of thought. Serious: sort of a brain wave.

The few investigations made in order to find out whether pure color-images could be symbolized with lines show that it is chiefly the exciting and quieting elements in the colors which induce the shape of the lines. The different types of lines which we have separated are divided in the following way:

Red: $c_1 = 3,\ a = 1,\ c = 1, c + c_1 = 2$
$H = 2, U = 2, D = 2.$

Blue: $a = 5,\ b = 2.$
$H = 7.$

In the red lines we see that the small waves and acute angles are in the majority; in the blue the big and low waves. Regarding direction, all the blue lines are horizontal like the lines of group II (quiet and its synonyms). In the red lines the different directions occur in equal numbers. The introspection of the subjects gives a key to the explanation of the lines.

G: The red line is the line of gaiety, of warfare. A cruel line.
L: Red line like the furious and the fiery.
S: Red line like fire.
D: Red line like anger.
F: Red line fiery.
Ma: Red implies great intensity, energy, and saturation.
G: The blue line is gentle, placid, and calm.
L: Blue line is serene like quiet water.
S: Association from the quieting blue sky.
D: Blue line is sad.
F: Blue line is calm and faint.

In some cases no introspection was given by the subjects. There is a certain interest in observing that with the color lines concrete associations seem to have been more lively than with the other lines. If we connect the facts noted with our previous results it is quite obvious that the red line is the active and energetic type, while the blue is quiet.

The material gained from the drawing of beautiful and ugly lines can not be classified according to our previous basis of separation. The types of lines are too varied. The introspection, nevertheless, hints at general tendencies in drawing those lines.

BEAUTIFUL

G: Gradual curves. The line gives what is expected. No interruptions in it. A beautiful line is always symmetrical. There is a dignified quality in the beautiful line. It is smooth.

L: Graceful movement is connected with a beautiful line. It glides along and is always made up of curves. Association: waves of the sea.

Mi: A beautiful line has continuity and is not crossed by any other line. Association: a swan.

S: A circle is a beautiful line. It is satisfactory because it is symmetrical and curved.

C: A beautiful line swings smoothly and is round and curved. All the curves have the same form. Smoothness and roundness are necessary for a beautiful line.

D: A beautiful line has a harmonious fusion of its different parts. It has a certain symmetry and very little conflict. It expresses a single and harmoniously blended idea.

F: A beautiful line is symmetrical, smooth and round.

Ma: Gradual transition is necessary in a beautiful line. It cannot have any straight parts. It is sweeping.

UGLY

G: The ugly line is just like a mass. Curves, angles and straight parts are mixed together, without organization. You get ready for a curve and then you have something else. Constant changes from unpleasant to more unpleasant.

L: An ugly line must have angles.

Mi: An ugly line has no continuity. Straight lines, curves and angles are mixed up.

S: The ugly line goes nowhere. Has no feeling.

C: The ugly line is a sort of conglomeration; is meaningless and broken up. It is like a mass. No uniformity in the curving. The intersections make the line ugly.

D: Ugly lines have no unity, no harmonious fusion between curves, straight lines, and angles. A conflict of different emotions is caused thereby. The curved line has one feeling-tone, the angles another, and the straight parts a third. Even a conflict of movements.

F: The ugly line is asymmetrical and has angles.

Ma: In ugly lines there is a conflict between different parts. The unrelated spaces make the line ugly.

We can easily deduce from these introspective statements that certain qualities are necessary in a line in order that it will appeal to us, and that the absence of these qualities makes the line ugly. The chief criteria of a beautiful line seem to be the following: unity in direction and movement, continuity, absence of angles and intersections, a periodical return of the same elements or a certain symmetry.

Summary

A résumé of the chief results regarding the affective tone of lines gained through the experiments can be formulated in the following sentences.

There seems to be a feeling tone connected with pure lines, which is perceived by a majority of observers.

This feeling tone is probably dependent upon the suggestion of movement in the lines; that is, the lines appear to imitate in their movement the motor expression of emotional states.

Slow and weak movement is suggested by lines with long and low waves, rapid and intense movement by lines with small waves and acute angles.

Consequently, emotions with little motor expression are suggested by lines of the former type and emotions with strong motor expression by lines of the latter.

A finer differentiation of the emotions suggested is not possible. Sad, lazy and quiet lines have practically the same shapes; likewise the furious and exciting are similar.

When sharp angles predominate in a line of the active type, it seems to acquire an unpleasant feeling tone, as well as an increased intensity in its movements. Thus, a jolly and a furious line differ in the frequency of the acute angles.

Strength is very often expressed by big and high waves; and even by right angles at times.

Broadness of a line indicates strength, while thinness indicates weakness and faintness.

Beauty in a pure line is expressed by unity of direction, continuity, roundness of curves, lack of angles, and periodical repetition of similar elements, or by a certain symmetry; ugliness by the reverse of all these qualities.

With these facts in mind we can understand why pure lines are an emotional factor in art and why they are an important factor in our enjoyment of the great masterpieces.

THE LAW OF HABITUATION

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There is a rather large group of facts of an æsthetic order that apparently have not received full recognition. They have not been differentiated from the general mass of conscious experience, nor adequately described by any existing psychological principle or law. They have consequently not been given any distinctive name. The only way I can refer to them, therefore, is to point out a few of their most striking examples.

The instance of these facts that has been most carefully studied up to the present time is the development of the feeling of consonance. The Greeks recognized only the octave as a consonance; in the fourth century the fifth and fourth were accepted; in the eleventh the major third; in the twelfth the major and minor sixths; and today we seem to be on the verge of accepting the sevenths, if we have not already done so. This orderly change of appreciation, or value mutation, attracted the attention of H. T. Moore and suggested a series of experiments performed by him,[1] in which he succeeded in artifically changing the appreciation of his subjects as a result of repeated stimulation. Comparable to these changes in the appreciation of musical intervals are changes in the appreciation of timbres. The modern ear enjoys far more complex timbres than the ear of a century ago. Even Wagner's music which to us seems easy to appreciate was called in his day 'shrill noise and broken crockery effects.' The rapidly increasing size and complexity of the modern orchestra is the external indication of the internal change going on in the public mind. Color combinations are also subject to changes of appreciation. The average person has

[1] 'The Genetic Aspect of Consonance and Dissonance,' *Psychol. Monog.*, No. 73, Sept., 1914.

distinct likes and dislikes among color combinations, probably more combinations being disliked than liked. But with those artists who are essentially colorists there seem to be very few and sometimes perhaps no color combinations that are truly disliked.[1]

Something of a similar sort seems to hold with regard to linear proportions. The layman may have distinct preferences for particular proportions, the golden sections and its neighbors, for instance, but an architect pays little or no attention to these simple proportions. Indeed, the relation of the lengths of lines to one another seems to be such a negligible factor to him that he generally means by proportion a totally different thing. In this connection the gradual thinning in the course of time of all the architectural members of the classic temples is perhaps significant. Compare the squat early Doric temple with the slim and lofty Roman temple. There is a somewhat parallel thinning out of proportions from the early Romanesque to the extreme Gothic.

In verse rhythms we can detect similar changes proceeding there in cycles. For instance, consider the strict metrical rhythm of Spencer and his time, the freer rhythm of the Shakespearean dramatists becoming freer and freer even in Shakespeare himself till it broke down into virtual prose in Webster, then the gradual tightening to the strict metrical rhythm of Pope, the loosening of the rhythm with the Romanticists, and again its break down to virtual prose in Browning, Whitman, and the whole modern school of *Vers Libre*. Examples of this sort could be multiplied out of the history of the arts. And among such examples must not be omitted the cycles of fashion in dress, furniture, gardens, and the host of minor arts.[2]

All of these are undeniably changes in appreciation, value mutations. There is furthermore apart from minor differences a generic quality about them that suggests that they are various manifestations of a single principle. In one place

[1] S. C. Pepper, 'Changes of Appreciation for Color Combinations,' Psychol. Rev., 1919, 26, 389–396.

[2] A. L. Kroeber, 'On the Principle of Order in Civilization as Exemplified by Changes of Fashion,' *Amer. Anthrop.*, 1919, 21, 235–263.

and another where a psychologist or a critic is driven to explain some of these facts, we find it vaguely intimated that they are due to imitation, or habit, or fatigue, all well recognized psychological principles. But the very number and diversity of these principles casts suspicion on the adequacy of any of them.

Imitation is undoubtedly a prominent factor in any social phenomenon, and therefore also in this one. If it comes to be thought 'the thing' to appreciate Browning or Gaugin, the flock may grow to appreciate them largely from the influence of social suggestion. But there must always be at least a small group who began to like these things without the pressure of social suggestion. At the very least there was the artist who made the work of art. When discussing the fashions, it is usual to say at this point that of course it is merely a game on the part of designers and storekeepers to keep up a constant flow of sales. We hear the same thing said even of artists. There may be a few exceptional cases where the insinuation is true. But those who make it universal are ignorant of the lives of artists. Shelley, Beethoven, and Rembrandt were not making what their contemporaries considered queer works of art as a money-making scheme. They were following the dictates of their taste, and their taste differed from the general run of their contemporaries. In a lesser way the same is probably true of designers in the minor arts. Indeed, strict reasoning from the principle of imitation would make changes of appreciation utterly impossible, for if taste were wholly governed by imitation, the taste of artists would be also governed by imitation and the art of each age would then have to be essentially similar to the art of the age before. That obviously is by no means the case.

The principle of habit leaves us in the same difficulty. It is said that we get used to strange things from seeing them often, and then we are able to appreciate them. But again we must ask, where did the strange things come from in the beginning. The work of art must first exist before we can get used to it, but the artist is apparently used to it before it exists. Habit is a conservative principle, but the principle at work here is radical. These changes of taste are what disrupt schools rather than crystallize them, and it is this active disruptive power that we must explain. Furthermore, habit has a tendency to drag all elements towards affective neutrality, and if possible into unconsciousness and mechanism. When we get used to the picture on our living-room wall, we virtually do not see it any more. That is why many people of sensitive taste change their pictures often. But the principle we must discover in order to explain our group of facts is one that increases our appreciation of things, not decreases it. It does not change our appreciation of all musical intervals to affective neutrality, but to rather high liking; nor of all color combinations to indifference, but to positive delight. As with imitation, our principle, whatever it may be, must at root be opposed to habit rather than allied with it. Far from being identical with habit, our principle must be strong enough to break through it and overcome it.

The principle of fatigue is more plausible. It is pointed out that when we hear too many consonances in succession we get tired of them and crave a dissonance. After a certain amount of sweet we crave sour. In the same way, it is said, after a number of years of tight skirts we crave full skirts, and after a century or so of the rigid rhythms of Pope we crave the looser rhythms of *vers libre*, and after ten centuries of octaves we crave the piquancy of the perfect fifth. There is an analogy between the principle of fatigue and the principle we are seeking, but upon consideration obviously a very distant one. For fatigue is rarely a matter of more than a few minutes, hours at most. It is terminated with sleep at the latest. But the principle we are in search of is something that runs over years and centuries. Two hours after we have been satiated with sweets we are ready for another sweet, and the desire for the sour we craved has disappeared. Twenty minutes after we have been fatigued with a monotony of consonances we are prepared to listen with pleasure to some other consonances, and to hear a dissonance unprepared would be painful. But the principle we are searching for must explain how a dissonance can come to be liked by a person as a consonance and (apart from the action of fatigue) be permanently liked. The principle of fatigue works on top of the principle we are searching for, and is of very much shorter duration, and probably of a fundamentally different nature.

It would appear, therefore, that the principle for which we are seeking is not a recognized psychological principle and consequently has not received a name. It occurred to me that 'habituation' might be as apt a name as any for it. And it seemed to me important some name should be given to the principle even if we did not know what the principle was, because if we can say the group of facts referred to at the beginning of this paper is governed by habituation, that at least signifies that it is not governed by imitation or habit or fatigue or any other recognized psychological principle, and that therefore a problem exists to discover what the principle of habituation is.

The solution of this problem consists in the accumulation, classification, and careful analysis of quantities of such facts as I referred to at the beginning, and a final generalized description of their behavior. Nothing of this sort has been done, least of all by me. All I wish to do is to call attention to an unsolved psychological problem of considerable magnitude, the very existence of which has hardly been noticed. The description of the law of habituation which follows is not to be regarded as more than most vaguely hypothetical. My hope is that by making a definite statement as to the nature of the law, criticism may be stirred up together with an active interest to discover by observation and experiment what the real nature of the law is.

Habituation seems to imply the existence of strings of connected dispositions. I propose to call such strings 'affective sequences.' An affective sequence is a group of connected dispositions such that if there is any affective change in one member of the group, there will be a definite affective change in every other member of the group. In other words, the group of dispositions works as a whole; an affective change in any one member of the group entails an affective change of the whole group. Such a sequence of dispositions would be that for the appreciation of musical intervals. The octave is most easily liked, then the fifth, then the fourth, then the third, then the sixth, then the seventh, and then the second. Now with the Greeks the octave alone was liked, the fifth was probably slightly disliked, the fourth a little more disliked, the third a little more, the sixth still more, the seventh still more, and the second yet still more. Due to some cause the fifth in the fourth century became very much liked. That meant that the octave was not so much liked as with the Greeks, while the fourth, third, sixth, seventh, and second were all more liked. A change in the affective disposition towards the fifth entailed a change in the affective dispositions towards all other intervals. The whole series of dispositions towards musical intervals hangs together and moves as a whole. That is what I mean by an affective sequence.

There are probably affective sequences for every class of psychological elements—affective sequences for single pitches, single timbres, single colors, single tastes, single smells; also for some classes of perceptions—for single lines, single rhythms, and the like; also for simple combinations of psychological elements, such as for musical intervals (combinations of pitches), and color combinations; and also for simple combinations of perceptions, such as combinations of lines and rhythms. These are separate affective sequences, because changes in one of these sequences have no direct influence upon other sequences. That is to say, a change in a person's appreciation of musical intervals does not create any change in a person's appreciation of color combinations. Thus an artist with a completely (so-called) educated taste for colors may have a very naive taste for music. There may, however, be relations of dependency between certain affective sequences and others. It seems probable, for instance, that a man's taste must be completely educated to single colors before he can proceed far with combinations of colors. In other words, there must probably be pretty complete habituation in the affective sequence of single colors before there can be any great changes of appreciation in the affective sequence of combinations of colors.

The condition of an affective sequence in an individual prior to any change of appreciation in its dispositions—*i.e.*, for example, the condition of an affective sequence at birth—I shall call the 'natural affective sequence.' The natural affective sequence for musical intervals, for instance, is probably a graded dislike for all intervals except the octave. Natural affective sequences are probably about the same in all individuals, just as the primitive system of reactions (instincts, if you wish to call them such) are essentially the same in all individuals. These natural affective sequences are the crude materials on which habituation begins to work. And since these crude materials are (barring slight individual differences of aptitude and the like) the same in every one, the differences of taste we see about us are entirely the result of habituation.

The active element that causes the changes of appreciation in affective sequences is stimulation. The rapidity of the change of appreciation within an affective sequence is a function of the frequency and vividness of the stimulation and probably of some other more recondite factors also. It takes a certain amount of stimulation to produce a change in an affective sequence, the larger the amount and the more strongly reacted to, the more rapid the progress of habituation. There are also other factors probably not reducible to these. For example, stimulation of dispositions just below the point of affective neutrality seems to produce more rapid habituation than the stimulation of dispositions situated elsewhere in the affective gamut.

We are now able to describe roughly what the course of habituation is. It begins always on a natural affective sequence. The natural state of an affective sequence differs with each sequence. In the sequence of pitch intervals, as we just saw, the line of affective neutrality comes just after the octave, all other intervals being disliked in the natural state of the sequence. In the sequence of color combinations, however, there are probably a considerable number of combinations that are liked in the natural state, though most color combinations are disliked. And in the sequences of single pitches and hues nearly all the elements in the sequences are probably liked in the natural state. The position, therefore, of the line of affective neutrality in the natural affective sequence differs for each sequence, and has to be discovered separately in each case.

There is a general rule that seems to be roughly true, however, and that is that the more complex the elements of a sequence, the less the number of elements in it that will be liked in the natural state of the sequence. Thus as a combination of pitches is more complex than a single pitch, there will be more elements liked in the natural affective sequence of single pitches than in that of combinations of pitches. Indeed the rule of complexity goes even farther, for where there is a difference of complexity among elements in a single affective sequence, the simpler elements are more apt to be liked in the natural state, the complex ones to be disliked. So it is with musical intervals, and with timbres, rhythms, and proportions; the octave, the pure tone, the tum-tum rhythm, and the one to one relation of clear symmetry are the simplest elements in their respective sequences and the most easily appreciated. But it is difficult to see how the rule could be made universal, for there seem to be affective sequences of elements that cannot be said to differ in the least in respect to complexity. There is no difference of complexity, for instance, among single colors, and yet there seems to be an affective sequence. In short, where there are differences of complexity whether among the elements of a single sequence or among whole sequences, the simpler elements and the simpler sequences seem to be the easier to appreciate. But the rule of complexity is not adequate to explain the relative ease of appreciation (or in other words, the relative position of the line of affective neutrality) in all cases, because there seem to be affective sequences where there are no differences of complexity.

The natural state of an affective sequence, then, (which has to be discovered for each sequence) is the starting point for every habituation mutation; and repeated stimulation of the dispositions composing the sequence is the motive power that produces the mutation. In order to make the progress of habituation clear, let us imagine an affective sequence composed of four elements only, viz., *a*, *b*, *c*, and *d*; and let us assume that in the natural state of this sequence *a* is very much liked, while *b*, *c*, and *d* are disliked, *b* a little, *c* more, and *d* still more. The line of affective neutrality would then fall after *a* and just in front of *b*. This situation is diagrammatically represented in (1) (cf. Diagram). That is to say, (1) represents the natural state of our imaginary affective sequence.

Now, as a result of repeated stimulation, that sequence will pass through stages (2), (3), and (4), which constitute the first phase of the mutation. In each of these stages a new element is brought from dislike to liking, a change which entails changes in all the other elements of the sequence. The element newly liked jumps from dislike to extreme liking with a single leap. And this leap is characteristic of habituation. When a fresh element is gained for liking out of the limbo of dislike, it is showered with adoration like a new social hero, until another fresh element comes out of the limbo and shoves its predecessor aside into the company of the stale heros. Musicians will recall the consecutive fifths and fourths of the ninth and tenth century songs. These intervals newly gained for appreciation could not be too often repeated but were called for over and over again. Later the thirds shoved them aside, and then consecutive fifths became the cardinal sin of harmony.

The first phase, which I have called the continuous phase, proceeds until all the elements of the affective sequence (or nearly all) have been drawn from dislike to liking. This process is what is largely meant by 'education of taste.' A thoroughly educated taste is a thoroughly habituated one.

But a time comes when all or practically all of the elements are liked. Then the second phase of the mutation begins which I have called the cyclic phase. This is represented diagrammatically by stages (5), (6), (7), and (8). It consists in a movement forward and back from extreme to extreme of the affective sequence. At (4) *d* is most liked, at (6) *a*, at (8) *d* again. And between the periods when the extremes are most liked, the means are most liked. This pendulum swing is clearly seen in the case of verse rhythms above referred to.

It is probable, however, that when the elements of an affective sequence are extremely simple the cyclic phase of habituation is absent. Affective sequences, for instance, of single colors, single pitches and the like have no cyclic phase. Such elements once they have been drawn out of the field of dislike are absorbed into a rather intense and indiscriminate liking. But the more complex the elements of an affective sequence, the more clearly the cyclic phase exhibits itself. It is as if there were only a certain limited capacity of appreciation, as there is only a limited capacity of attention. And as in the case of attention when we cannot attend to all the elements of a complex whole at once, we make up for our deficiency by attending to each of the elements in succession; so apparently in the case of appreciation when we cannot like all the elements of an affective sequence equally, we make up by intensely liking each of the elements successively. The prominence of the cyclic phase, therefore, is a function of the complexity of the elements composing the affective sequence.

In short, as a result of repeated stimulation the elements of an affective sequence are first drawn from dislike to liking; and then in case the elements are too complex to be absorbed into a rather intense and indiscriminate liking, the affective sequence acquires a new movement, a pendulum swing from extreme to extreme of the sequence through a point of intense liking. This mutation in both of its phases is a matter of months, years, and even sometimes of centuries.

Where the mutation is a matter of months and years, it is obviously explainable entirely in terms of individual psychology. A query, however, might arise how the mutation could cover centuries—as apparently it often does—seeing that the life of a man does not exceed four score and ten. It does not seem to me necessary to postulate an over-individual social organism to explain this fact. What the fact means is that it takes a great deal of time for individuals to work up to an appreciation of new elements when these elements have not found a place in the art of the age.

It took us seven centuries of music to work up from the fourth and fifth to the major third, because during that period the fourth, fifth, and octave were the only intervals commonly heard and the major third was used only timidly and apologetically. Furthermore, a shell of custom (habit) in the form of papal edicts surrounded the fourth, fifth, and octave which had to be broken down by the impact of habituation before the major third could gain acceptance. A child of the eighth and ninth century, therefore, had no opportunity to become habituated beyond the interval of the fourth. But for a child of the eleventh century, after the major third had broken through the constraint of custom and was to be met with in music on every side, it was a quick matter to become habituated to the third and then be ready for habituation to the next element of the affective sequence.

So, through the stimulation of the prevalent art of an age the children of each generation rapidly catch up to the taste of their parents, while their parents are making but slow progress in habituation. That is what causes the habituation mutation frequently to run over whole centuries. Yet in every case the explanation lies in the psychology of individuals, in the movement of affective sequences within single organisms.

Diagram. Illustrating Law of Habituation

Continuous Phase.	*a*	*b c d*	(1)
	b *a*	*c d*	(2)
	c *b a*	*d*	(3)
	d *c b a*		(4)
Cyclic Phase.....	*c d* *b a*		(5)
	a *b c d*		(6)
	c d *b a*		(7)
	d *c b a*		(8)

XXVII. THE EFFECT OF CAFFEIN AND ACETANILID ON SIMPLE REACTION TIME[1]

BY WALTER SCHILLING

The drugs used in this work were caffein alkaloid (*Caffeina;* U. S.) and acetanilid (*Acetanilidum;* U. S.). They were administered in the form of capsules containing 5 grains each. Sugar of milk was also administered in a similar dose as a "control." It is of the same appearance as the drugs and has a negligible physiological effect.

The subjects were student volunteers who were called on for three periods of fifty minutes each. In nearly every case it was so arranged that the succeeding periods fell one week apart at the same hour as the first one. None of the subjects had used the drugs under consideration, except as they occurred in coffee and tea, or, very rarely, in headache remedies.

The apparatus consisted of a Hipp Chronoscope with the necessary connections for operating without springs, according to Dunlap's method; when tested previously it showed a variable error which did not exceed 1.4 σ, and absolute errors as follows: at 100 σ the readings are 10 σ too low, at 200 σ and 250 σ they are 30 σ too low. These absolute errors, be it noted, insofar as they affect the results, do so in the direction of tending to hide rather than to increase the tendencies discovered.

In addition there was provided for the subject a sphygmograph, applied to the external carotid artery, and a pneumograph with the necessary devices for recording on a kymograph. A pneumatic contrivance also recorded the instant that the stimulus was given. A clock, connected electrically with an indicating needle, marked ten-second intervals on the record. Screens were set about in such positions that the subject could not see either the mechanism of

[1] From the Psychological Laboratory of the University of California.

the chronoscope, the moving part of the kymograph, or the experimenter's key.

The reaction was an auditory one, the warning signal being the starting of the chronoscope mechanism, and the stimulus itself the click made by engaging the clutch in the chronoscope when the stimulus circuit was closed.

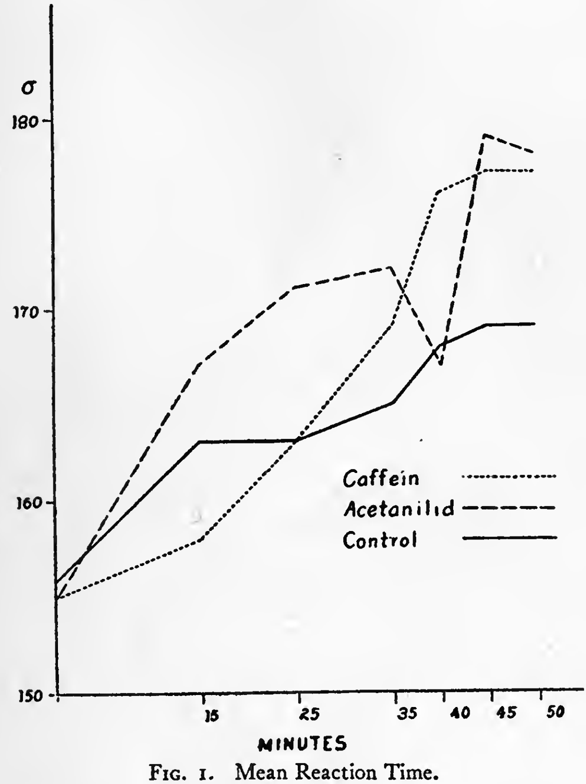

FIG. 1. Mean Reaction Time.

Immediately after taking a capsule containing either a drug or the control, about ten practice reactions were given in order to familiarize the subject with the method of procedure. The taking of the 'normal' series of twelve reaction times immediately followed. These were always completed within ten minutes, a time too short for any other than a suggestion effect and a possible physiological effect resulting from the stimulation of the alimentary tract due to the swallowing of the capsule, regardless of its contents.

The capsule did not, in all probability, dissolve for ten or fifteen minutes, and by the time that the drug had been absorbed into the system, twenty or thirty minutes would have elapsed. The 'normal' was usually completed within seven minutes after swallowing the capsule.

Further records of twelve reactions each were taken at successive intervals of fifteen, twenty-five, thirty-five, forty, forty-five and fifty minutes after administration. This completed the first series of tests for the subject. He appeared again, usually a week later, and for a third time after still another week. The procedure was the same on each occasion except that the contents of the capsule were different. No regular order was followed in the administration of the drugs or the control.

Of the twelve reaction times in each series the mean was found, and the two reaction times deviating most from this mean were cast out. The mean of the remaining ten was then considered the result for that period of time and for the drug in question.

The figures for the mean reaction time (*MRT*), the probable error *PE*,[1] the standard deviation *SD*,[2] and the ratios *SD*/*MRT* are given in Tables I, II, and III. (Cf. Fig. 1.) The mean reaction time at the end of fifty minutes is slower in nearly every case than it was at the beginning of the experiment,[3] but the retardation where drugs had been used is somewhat greater than with the control dose. The figures

[1] The probable error of the mean reaction times were obtained by the formula:

$$PE_M = \frac{0.6745SD}{\sqrt{n}},$$

where $n = 20$, and where the deviations used in computing *SD* were the deviations of the mean reaction time for each subject from the mean for all the subjects.

[2] The standard deviations (*SD*) were calculated for the individual subjects by means of the formula:

$$SD = \sqrt{\frac{\Sigma(d^2)}{n}}.$$

The *d*'s in this case were the differences between the individual reaction times in each series of ten, and their mean. The *SD*'s so obtained were averaged for the twenty subjects.

[3] Caffein: 17 subjects slower, 3 faster; Acetanilid: 17 slower, 3 faster; Control: 16 slower, 4 faster.

for the latter probably represent, with a fair degree of accuracy, the effect of fatigue as well as the mental excitement attendant on the experiment. In general therefore, it appears that the drugs slow the reaction time more than would normally be the case without them.

TABLE I

MEAN REACTION TIMES FOR CAFFEIN IN σ

Subject	N	Interval After the Dose, in Minutes.					
		15	25	35	40	45	50
1	204	213	200	190	178	197	201
2	139	127	150	134	156	163	151
3	188	201	190	174	178	179	193
4	165	158	159	189	188	189	182
5	161	146	171	202	197	164	176
6	123	122	136	135	149	162	165
7	157	147	181	155	165	189	178
8	149	133	128	141	144	151	137
9	152	214	165	174	190	142	165
10	144	160	149	163	195	163	173
11	141	129	147	148	164	144	160
12	138	162	166	209	196	266	241
13	147	136	155	167	172	168	152
14	165	198	185	181	180	196	228
15	129	140	166	144	171	171	155
16	151	169	164	191	206	202	171
17	175	156	167	159	156	178	162
18	144	148	162	176	160	166	180
19	182	169	168	197	224	200	218
20	150	129	153	148	144	146	153
Mean	155	158	163	169	176	177	177
P.E.	3.0	4.2	2.6	3.4	3.4	4.2	4.0
S.D.	20.0	21.9	23.4	26.1	25.9	23.0	21.7
Ratios S.D./M.R.T.	12.9	13.8	14.3	15.4	14.7	12.9	12.2

The individual reaction times for all subjects, from 35 to 50 minutes inclusive, were lumped (Table IV) resulting in the ogive presented in Fig. 2. There were 800 reaction times per drug, but as some of them fell so far from the main body as to be classed as idiosyncracies, the number represented by each curve was reduced to 765. Reference to Fig. 2 shows that the reactions under the influence of the drugs is slower for all groups of reaction times, barring a slight speeding up with acetanilid in the 111–120 σ group. This may be taken as a quite definite indication, as the curves are based on the individual raction times, irrespective of the different subjects. Acetanilid seems to show faster reactions than caffein when the reaction times are under 190 σ, but when over this, caffein appears to give faster reactions.

An attempt was made to determine any difference in the effect of the drugs on smokers and non-smokers. On this basis, a division of the subjects was made into two groups,

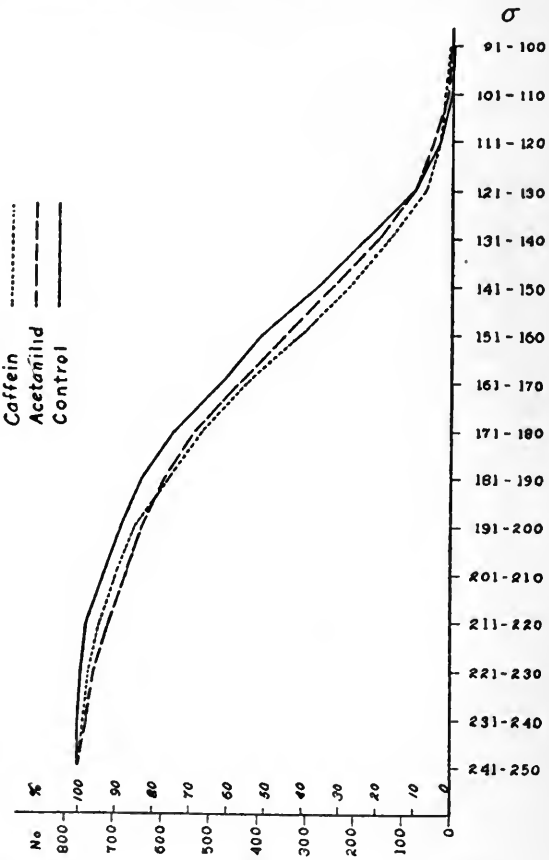

Fig. 2. Cumulative Frequencies of Reaction Times for Different Limits of Speed.

the first, or 'smokers' group, containing 11 subjects, and the second, or 'non-smokers,' comprising 9 individuals. It will be observed (Table V.) that the numbers give no indication of any clear effect from the use of tobacco.

The figures seem to show that the deviation—that is, the unsteadiness under the influence of the drugs—is greater than with the control.[1] That these results are not due merely to the changes in the absolute sizes of the reaction times, may be observed by referring to the ratios *SD/MRT* (Tables I., II., and III.).

Table II

Mean Reaction Times for Acetanilid in σ

Subject	*N*	Interval After the Dose, in Minutes					
		15	25	35	40	45	50
1	205	198	200	219	223	253	244
2	120	128	141	162	156	173	152
3	171	193	234	206	196	203	244
4	161	176	172	162	154	195	169
5	133	157	161	177	177	190	200
6	172	145	149	155	158	156	166
7	120	123	122	131	135	131	133
8	151	190	149	181	139	148	148
9	135	136	147	157	131	140	141
10	155	151	158	160	168	177	168
11	126	148	151	141	141	156	130
12	173	173	177	197	191	202	220
13	149	246	155	151	157	151	164
14	208	198	242	197	174	193	177
15	153	191	169	221	167	204	165
16	165	160	164	190	196	198	227
17	148	151	174	154	152	167	180
18	173	172	167	173	174	194	191
19	155	171	218	188	208	197	191
20	134	141	167	152	147	149	147
Mean	155	167	171	172	167	179	178
P.E.	3.0	4.4	4.6	3.9	3.7	4.4	5.1
S.D.	22.6	25.9	26.8	27.2	18.8	24.1	23.7
Ratios S.D./M.R.T.	14.5	15.5	15.6	15.9	11.2	13.4	13.3

Respiration and pulse rate showed some interesting variations as affected by the stimulus. Some of the subjects maintained a normal respiration and a normal pulse throughout the experiment. Others showed irregular respiration and a normal pulse. Several indicated exactly the reverse; while one record presented evidence of great disturbance when the stimulus was given. In this case the subject moved the reaction key not only by contracting the muscles of his fingers, wrist and arm, but also by contracting his chest and neck muscles suddenly.

[1] *SD* with caffein greater in 12 subjects and with acetanilid greater in 14 subjects than with the control.

Table III

Mean Reaction Times in Control Experiment in σ

Subject	N	Interval After the Dose, in Minutes					
		15	25	35	40	45	50
1	236	211	186	215	213	196	206
2	144	131	138	134	151	127	168
3	155	188	174	164	178	186	192
4	161	164	194	165	162	173	178
5	153	184	160	166	169	161	178
6	138	140	148	166	148	150	136
7	122	126	147	129	128	143	133
8	133	149	140	144	144	151	152
9	141	189	162	166	189	171	201
10	148	149	162	153	161	174	149
11	155	149	153	143	148	144	159
12	195	170	158	291	226	197	210
13	142	156	157	163	155	176	164
14	188	216	191	186	197	180	178
15	129	146	144	125	146	140	136
16	170	192	217	183	178	263	168
17	152	153	155	149	159	171	190
18	142	158	156	157	182	177	174
19	158	137	163	146	179	155	160
20	152	156	146	158	156	146	155
Mean	156	163	163	165	168	169	169
P.E.	3.8	3.8	3.0	5.3	3.6	4.3	3.4
S.D.	21.8	24.5	21.8	21.8	22.1	22.0	18.0
Ratios S.D./M.R.T.	13.9	14.4	12.7	13.2	13.1	13.0	10.6

Table IV

Cumulative Frequency of Reaction Times for the Different Limits of Speed

Reaction Time (σ)	Caffein	Acetanilid	Control
91–100	2	2	2
101–110	10	6	6
111–120	23	31	24
121–130	56	78	78
131–140	128	150	175
141–150	208	242	267
151–160	305	340	369
161–170	415	436	471
171–180	508	522	563
181–190	580	584	638
191–200	646	635	678
201–210	686	666	714
211–220	721	702	742
221–230	746	730	758
231–240	757	753	765
241–250	765	765	765

The evidence brought forward therefore, so far as it goes, gives the following indications:[1]

[1] It should be understood that whenever the terms caffein and acetanilid are used, they refer only to 5 grain doses in capsules.

1. Caffein and acetanilid each retard reaction time. The effect is more pronounced in the case of caffein.

2. A greater unsteadiness appears to be produced by either of the drugs than by the control.

TABLE V

MEAN REACTION TIMES OF SMOKERS AND NON-SMOKERS

	N	Interval After the Dose, in Minutes					
		15	25	35	40	45	50
Caffein							
Smokers	147	150	155	166	174	178	189
Non-smokers	165	168	173	173	177	175	174
Acetanilid							
Smokers	157	162	171	168	168	177	174
Non-smokers	153	175	170	175	166	182	182
Control							
Smokers	157	158	161	168	170	169	164
Non-smokers	155	167	164	160	166	169	175

There are no especial indications with regard to the pulse and the respiration. The effects, if they exist at all, are masked by the direct mental effect of taking the capsules.

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CEREBRAL-MENTAL RELATIONS[1]

BY SHEPHERD IVORY FRANZ

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For this address I have selected one of the oldest topics which has attracted the attention and thought of psychologists, but which through the centuries has ever remained of import to them, and has appeared worthy of discussion, viz., the relations of mind and brain. To this topic, in the special ways in which it may be considered, psychologists, philosophers, and others have devoted both time and space. By some it has been looked upon as a special part of the more general ontological speculation, and in relation to their epistemological musings it has been considered by others to be the more general problem. Whether or not there exist, in a philosophical sense, one or both of the things commonly called mental and material need not concern us in our scientific work; nor, except for our interest in the gymnastics of the thing we speak of as mind, need we consider the so-called causal relations of mind and body. I can conceive that the adoption of the relativity fashion may change our point of view. Psychological clothes may have to be cut more décolleté to compensate for the shortening of the skirts. Until, however the fashion is generally adopted, we may be satisfied with a more conservative, a more modest and unpretentious mode.

We may adopt as a working creed, but without a stable philosophical bias, the view that there is a mental, and that there is a physical. Until they are definitely shown to be

[1] Address of the president, before the American Psychological Association, Chicago Meeting, December, 1920.

one and not two, we may also believe for our practical purposes that these two are related somehow and in some way, and that the part of the so-called physical with which we may be chiefly concerned is that part called the nervous system. We should also recognize various orders of facts: (1) many facts regarding the nervous system may be discussed without reference to those terms that connote mental processes; (2) many facts regarding the mind are associated together without any knowledge of probable or possible cerebral intervention; (3) some mental states are known to occur when there are changes in the brain or in the nervous system; (4) when there are defects of the brain concomitant variations from the usual or the normal mental states are frequently observed; (5) mental differences exist without known structural or functional nervous alterations; and (6) certain brain variations are not accompanied by known mental variations. We are justified in dealing separately with the neurological facts and with the mental facts, and when concomitant variations are found we are also justified in trying to see stereoscopically the two sets of facts at one time, even though we may be unwilling to believe our eyes that the resultant picture represents reality, and even though we may be unwilling to ascend or to descend into the realms of philosophy to discuss causal relations or primacy. It is in this simple, naïve, artless (maybe ingenuous) way that my paper deals with the cerebral-mental relations. It is to the mental alterations accompanying cerebral lesions, and to the subsequent return to a normal or almost normal mental state without a corresponding recovery of normal brain condition, that I desire especially to direct your attention.

Before proceeding to the recounting of some of the facts which should be better known than they appear to be, it is well to report in a few words some of the conclusions of our scientific predecessors regarding these matters. The views of interest to us at this time do not antedate the work of Gall. Regardless of what we may conclude with respect to Gall's deductions and teachings, there can be little question that he was the great catalyzer who brought about or recreated an interest in the scientific study of cerebral functions in relation to the mental. Two erroneous assumptions were made which vitiated the conclusions of the phrenologists: the first, psychological, that the mind is a complex of relatively independent faculties; the second, physiological, that the brain form corresponds with the outside skull form. Gall was more conservative than most of his followers, but his observations, incomplete but spectacular, led to the belief and to the teaching that the bony configurations of the skull are directly correlated with the mental faculties. Numerous observers, making numerous observations, failed to find these correlations, and Gall's conclusions were not confirmed.

This failure to find a satisfactory correlation soon led to the acceptance of the converse view. This is represented notably by Flourens, who held that the brain functions as a whole, all parts in every mental state, and that there is no mental function to be referred to any one cerebral part.

Many subsequent accurate observations of the brain in cases of injury or disease, especially by the French clinical neurologists, resulted in a reaction against this "all or none" view, and the culmination of this series came in the announcement by Broca of the discovery of the cerebral center for motor speech. When to this important cerebral-mental observation there were added the results of the later stimulation and extirpation results on animals, and the clinico-pathological observations of many observers, there was a return to a belief in the possibility of cerebral localization of mental functions, but not to the crude form that is evidenced in the writings of Gall and his followers. A later development of this scientific movement in seeking for definite localization of faculties, or mental processes, which had vogue and many followers a few years ago, is that of the histological localization of function. To the extreme form in which their conclusions have been presented I had occasion to offer a criticism some years ago. According to some of the histologists there are, for example, certain sensory cerebral centers and certain other perceptual or psychic centers. This conclusion is based on relatively crude histological and chemical observations and naïve assumptions. Because, for example, two or more cerebral parts show some anatomical or chemical similarity they have been assumed to have similar or like functions. To put the matter crudely, although not in the words of the histologists, we should believe that because the brains of John Smith and Peter Jones look alike, because they have the same staining qualities, and because they have the same arrangement of cells and fibers, the two individuals should have had the same likes and dislikes, the same sensations and the same actions. This is well expressed by Lugaro who says, "The structure of the brain statically symbolizes . . . all that may occur in consciousness."

It is not my desire to utilize the time to criticize the past or to point out the incompletenesses of observations, the logical errors and the philosophical bias of our predecessors. I prefer rather to detail the present, to bring before you some recent observations, and to hope briefly of the future.

Let us start with some consideration of aphasia, since this particular series of defects has led many observers to travel the road of a modified phrenology. It will be remembered that the usual explanation for motor aphasia, whether it be articulatory or graphic, is that the inability is due to loss of kinesthetic images. In other words, it has been believed that the destruction of certain cerebral cells, or the breaking of the cellular connections, has robbed the individual of images which he had. If this explanation corresponded in general with the actuality, there would remain a more perplexing problem in connection with the processes and results of reëducation. Assuming for the moment that there are those cases in which the motor aphasia is not due to an anesthesia or to a sensory aphasia, how can the kinesthetic images be reproduced? Will it be necessary for the individual to go through a random series of movements, selecting those that please him, and finally after many trials and many errors, getting the correct motor response? Does the individual have the kinesthetic idea produced or re-created when the correct response is first given, or is the kinesthetic image or idea present only when the patient is able to make the necessary motor adjustments and reactions invariably?

In the memoirs of an aphasic physician, which have recently been reported for us,[1] there is an interesting series of observations which I recommend to you. Dr. Saloz, the patient, had a 'stroke', which did not produce unconsciousness, and there was no paralysis, but he was totally unable to speak, and had verbal deafness and agraphia. He lived six years after the cerebral injury, and he died from another disease. His brain showed 'considerable atrophy of the whole left hemisphere, and the results of a vast, exclusively sub-cortical destruction, extending over the whole zone of language.' During the six years between the 'stroke' and his death, he recovered the ability to speak, to write, and to understand. When he was able to write well, he began an autobiography of his life during the period following his stroke and his recovery of speech ability. Parts of this account are, or should be, of great interest to psychologists, especially to the introspectionists. An important point for us at the present moment is the account of his condition immediately following the 'stroke.' Of this he says: "At the moment I had no lack of continuity of consciousness (présence d'esprit) or in my thinking, and although things appeared much changed, I knew exactly what I wanted to say; I took account of the fact that my intact sensations had only lost their psychological instruments of expression through the symbols of language."

In other places Dr. Saloz seems to incline to the belief that what is lost in motor aphasia is a group or series of ideas or memories, when for example he says that logoplegia, whether motor or transmission aphasia, is a deficit of the articulatory and motor memory. On the other hand it should be said that the technical terms used by the biographer are not always, or regularly, used in the same way that the psychologist uses the terms, and the deficit of memory to which he refers the disorder is explained in his conclusions as a 'general faculty of abstraction, above all from the point of view of the conception of the will, as prime mover to all activity.' He recounts that at times, especially in the morning, he found a 'mixture of dysarthria, with letter and syllabic

[1] F. Naville, 'Mémoires d'un médecin aphasique,' *Arch. de Psychol.*, 1918, 17, 1–57.

paraphasia,' due to 'a momentary forgetfulness of their sound and their place,' which brought about a 'deficient exteriorization.' In other words, the memory which is defective is a kind of sensory memory, upon which depends the understanding of heard and seen words, objects and the like.

Practically every patient with so-called complete motor aphasia retains the ability to say a few words. These are not always used correctly. Those most frequently retained are 'Yes,' 'No,' the patient's name, and very commonly a few simple oaths. Some of the verbal reactions that are given as apparently satisfying the patient's need of expression are amusing as well as pathetic. Such a case is that of a man whose expression was limited to "brown paper; no, green paper; no, biffin." This was his retained means of communication, at times unsatisfying to him but at other times completely satisfying his needs as he apparently felt them. This I say because of the evidence from his other overt behavior. Another individual was apparently satisfied by an 'ou-i, ou-i,' reaction at times, although he sometimes reacted as if disgusted with his inability to express himself, and as if his reaction came without volition on his part. Similarly a third patient said his name and his home address under all circumstances in attempting to communicate verbally. He would point to a paragraph in a letter from his sister, in which she asked about his condition, whether or not he needed money or clothes, and the like, or he would point to an object or to a printed word, giving voice to his name and his address. With this expression he was sometimes apparently quite satisfied, judging from his other reactions, and he would repeat these words over and over in different intonations as if he were saying a long sentence in which the words were more or less connected and emphasized.

I might also cite here other instances in motor aphasics with whom I have come in close contact to show the incongruities between the stimulus and the speech reaction, which incongruities were often not apparently appreciated by the patient. It is well recognized that the phenomena of paraphasia are frequently due to this lack of appreciation of appropriateness. What are we to say about such patients? It is simple enough to adopt the dictum of Marie that we are dealing with 'a marked diminution of intellectual capacity,' which might conceivably cause these patients to be satisfied with their performances. But, do the reactions themselves give us any indication of the presence of kinesthetic images prior to or at the time the reactions are produced? No more, I would say, than do the ordinary reactions of dressing, or even those of rolling a piece of food about in the mouth in mastication. A stimulus produces a reaction, it may be of the hand in tying one's tie, or it may be of parts of the mouth in mastication, or it may be a more complex reaction of the combined organs in vocalization. Our ordinary speech reactions are almost exactly the same as many of our other daily activities, they are learned reactions or habits. Many of them are so-called motor habits and others are so-called sensory habits. In this connection I would have you direct your attention to the phenomenon of automatic writing. This is carried on unconsciously or sub-consciously, if you wish to accept such terms. I prefer to look at the phenomenon as simply a special habitual kind of reaction, a reaction produced when the appropriate stimulus, complex if you will, has been presented. There is no evidence to warrant the belief that images of any kind are involved in this process, and the image-loss explanation for motor aphasia is just as gratuitous as would be the explanation that kinesthetic images are involved in automatic writing.

Years ago Hughlings Jackson showed us that in some aphasics the so-called images remain unchanged, but in the search for spatial localizations of mental processes in the cerebral cortex, his teachings have been disregarded, or forgotten, or repressed. The reactions of the motor aphasic in the process of reëducation are precisely those of an animal in the acquisition of a new habit. At first the stimulus, whether it be auditory or visual, a word or another object, leads to the easiest or the most natural response. If the patient has retained 'yes' and 'no' these words are constantly used. When other sounds are made, at first they are inapt, but after a time reactions become nearly appropriate and finally in the process of recovery they become definite, constant, precise, and adaptive. After a 'word' has been 'learned' and a new stimulus is given to the patient, he will go through a series of trial and error reactions, exhibiting his 'yes' and 'no' with his newly acquired word reaction, as well as a number of random speech movements as reactions to the new stimulus. He acts like the cat which, after having learned to open the door of the cage by pulling a string, is placed in another cage in which the string-pulling reaction must be replaced by a button-turning reaction.

In contrast to the foregoing, which has repeatedly been observed by me especially in the early periods of reëducation training, other significant observations were made in the teaching of motor and sensory aphasics. I showed to a patient pictures of objects and tried to get him to reacquire the appropriate vocalization reactions to them. After the patient had acquired the ability to react to a series of pictures in a suitable and regular manner I tried him on different pictures of similar objects. I then found that the particular reaction related to a particular stimulus was also obtained when other different, similar, appropriate stimuli were presented. For example, he formed the habit of saying 'hat' to the picture of a certain hat, but after this habit reaction had been acquired, the correct 'hat' reaction was obtained no matter what kind of a hat-picture was shown to him, and he did not voice the word 'hat' as the reaction to pictures of shoes or other wearing apparel, or of other objects.

In his suggestive study of similar cases of aphasia due to gunshot wounds of the cerebrum, Head[1] has also recorded numerous interesting facts which must be brought into some newer cerebral-mental relation than has been commonly taught. He asserts that "there is not a single manifestation presented by the defects of language, due to a unilateral lesion of the brain, that can be explained by destruction of auditory or visual images." His tests differed in many

[1] H. Head, 'Aphasia and Kindred Disorders of Speech,' *Brain*, 1920, 43, 87–165.

respects from those that are commonly used in the determination of a diagnosis and in the clinical localization of the cerebral destruction. They were simple and complex, and they were continued through the early stages of the defect into the period when the patients showed a considerable amount of recovery of both sensory and motor speech ability. In the examination of an aphasic to determine his ability to take in a situation as a whole he asked the man to draw a plan of a room with which he was familiar. The patient, "who was an excellent draftsman before the injury, started well, but forgot the windows and the doors; moreover, he placed his seat alongside the fireplace, whereas it was in the middle of the room. He forgot the table in front of him, but filled in several details . . . of little comparative importance." In other words, the patient could draw, but he did not get the relations of parts of his drawing. Disorders of this character and others which have been noted more frequently are, according to Head, 'produced by dissociation of a definite mental process,' which he has called a dissociation of "symbolic thinking and expression. They are not due to a loss of motor or sensory power, to destruction of images or to a diminution of general intellectual capacity, but are caused by the breaking up of one aspect of psychical activity analagous, on a higher level, to the sensory dissociations which may follow a lesion of the post-central cortex."

The cases that we have just considered, those in which language in its broadest sense has temporarily been abolished or interfered with on account of cerebral injury, and in which recovery has taken place, make interesting commentary upon the current views of the relations of mental processes to the brain. The facts demand less of the theorist's consideration and more positivistic, scientific investigation. As corollary to them, but without further discussion at this time, I would also direct your attention to the fact that there are also those cases in which cerebral destructions in the 'zone of language' have not been accompanied by corresponding clinical manifestations of speech disturbance. A number of such cases have been collected by von Monakow.[1] Some show destruction (cortical or subcortical) of Broca's area, others of Wernicke's 'sensory speech' area.

The phenomena accompanying destructions of the sensory and the motor systems of the cerebrum also have interest for us. We are aware that an individual may have a cortical lesion in the visual area, be blind to all new incoming stimuli, but retain the ability to see with the mind's eye. What is called the visual image may remain, even though there be a destruction of the parts of the cerebrum that are known in general to be concerned with the primary visual processes of sensation and perception. Monkeys which become blind after the destruction of the visual areas of the cerebrum may recover to such an extent that many of their ordinary visual-motor (I do not refer to the oculo-motor) reactions are carried out in an apparently normal manner. In the field of audition somewhat similar cases could be cited.

Lack of time prohibits a full consideration of many of the facts that can be cited in regard to sensory losses and sensory recoveries after cerebral lesions. With respect to the skin sensations following destructions of parts of the brain it is worth while to add a few words to what has already been reported regarding vision and hearing. Two collections of cells in the brain are known to be concerned with the sensations from the skin and the underlying tissues. These are the thalamus and the post-central cerebral cortex.[2] The thalamus is an afferent relay station for the impulses on the way to the cerebral cortex. It is an afferent station for the 'gross' forms of sensation, and through it there are brought about certain complex motor and visceral activities of the nature of reflexes. The cerebral cortex, on the other hand, is said to be concerned with the discrimination, including localization, of the sensations. A defect exclusively of this part of the cortex produces an inability to know more than

[1] C. v. Monakow, 'Die Localisation im Grosshirn und der Abbau der Funktion durch kortikale Herde,' 1914.

[2] Some contend that the sensory area we are considering overlies the precentral or motor, area.

the general fact that a stimulus, hot or cold or painful or tactile, has been received. Whether it be sharp or blunt, extended, narrow or thin, is not appreciated, and the fineness of localization is lost. The patient may know that some part of the leg or of the adjoining trunk has been stimulated, but he lacks the ability to locate the stimulus any more accurately. While this describes what I have also observed in lesions of the postcentral area, during the period after the cerebral insult and for some time thereafter, it is also apparent that some kind of adaptation or assumption of function does take place. Occasionally patients with an extensive destruction of this cortical area do not show the expected sensory alterations. I have in mind the case of a man whom I frequently examined, whose brain at autopsy showed almost complete destruction of the region we are considering. Because of the failure to find sensory disturbances I had not suspected that the lesion involved the cortex, especially the postcentral region, the remainder of the clinical picture being easily understood on the assumption of a combined, but relatively small, capsular and lenticular lesion. I first saw this patient several years after the cortical destruction, and we cannot be certain whether or not at any time he exhibited anesthesia or hypesthesia in the sense of being unable to discriminate and localize. Failure to discover the condition during the early days may have been due to a concomitant almost complete 'motor' aphasia, but in his last years in view of his speech reëducation this explanation cannot be seriously considered to be warranted. In some respects for my present purposes the case is not as clear-cut as could be wished.

A somewhat similar case to which objection of the same character cannot be offered has been reported for us by Brown and Stewart.[1] These authors had a patient with a gunshot wound of the left postcentral area which brought about an inability to localize stimuli on his right hand. Training in

[1] Brown, T. G., and Stewart, R. M., 'On Disturbances of the Localization and Discrimination of Sensations in Cases of Cerebral Lesions, and on the Possibility of Recovery of these Functions after a Process of Training,' *Brain*, 1916, **39**, 348–454.

localization was given, such as touching a part, and if the patient was not able to localize the stimulus, telling him where he had been stimulated. His attention was directed to the stimulus during the period of training, and he was advised to notice whatever he could that would enable him to make a localization by himself. One finger of the hand was selected for the training, in order that the localization ability of adjoining fingers that were not given 'training' could be compared with it. Any 'general' improvement of the hand as a whole could then be checked against a 'special' improvement due to the training. The results show a "marked improvement of the localization of tactile stimuli on the trained spots as compared with the accuracy of that localization on the same finger before the training, and with the accuracy of localization upon the other fingers after the training." The results in this case are, therefore, very similar to those in aphasics after reëducation. Some cerebral part other than the usual one has subsumed the function of the destroyed area.

Much could also be said of the relations of cerebral and especially cortical destructions in producing anomalous conditions of conation, will, volition, or whatever one cares to call that which goes on with voluntary activity. The destroyed brain parts are never regenerated, but many, perhaps all, patients who have had destructions of the precentral, or motor cortex, can reacquire the power of voluntary movement. In some cases this comes suddenly after a prolonged period of inability, in others it is a gradual development. So far as the crude introspective evidence goes the individuals have apparently not lost the things called kinesthetic images, they know what kind of a movement they desire to make and they have the other 'mental' predecessors of movement, but they fail in not being able to make the necessary muscles contract and relax. When in the process of sudden recovery the muscles are found to move voluntarily the result comes as a great surprise to them. This was the case with the soldier (with gunshot wound of the precentral area) who had unsuccessfully tried to move his fingers for more than six months, but who, after a few manipulations and at my insistent demand, found that the motor impulse did break through.

In most cases the recovery is gradual, the first attempts at voluntary movements are sometimes futile, but when the first movements are obtained the result is a diffuse, and sometimes exaggerated, general activity of more than that part of the body which the patient tries to move. Occasionally both halves of the body are moved simultaneously. Only after long practice do these patients become able to control the movements to such an extent that a special reaction can be obtained invariably at command. And at times, even after this regained ability, certain movements, as movements, cannot be carried out, although the elements of the movements can be properly executed. Thus, a patient may be able to pronate and supinate, flex and extend all parts of his arm, but he may not be able to combine these simple reactions into a complex that will result, let us say, in the throwing of a ball.

Moreover, a phenomenon to which I have previously called attention in relation to aphasic conditions is not infrequently encountered. This is a fluctuation in ability ranging from apparent inability to exactitude and regularity of control, these two extremes being found on successive days or from hour to hour on the same day. Some motor aphasic patients can sing but they cannot talk, some paralytics are found asleep with their arms above their heads although in the waking state it is impossible for them to make an extensive movement of the shoulder. Conversely, under conditions of interest, such as that of competition, the resulting movement may be much more efficiently carried out than in the dull, routine training in the laboratory. This was apparent in the patient who had been hemiplegic about eighteen years when I began his motor reëducation. After he had progressed to a certain point he was graduated to a baseball squad in which he took part in a daily game of baseball on a small boy's size field. One day he made a hit, ran to first base, and then asked a spectator to bring him his cane (which he had been accustomed to use during the eighteen years) 'because he could not walk without it'. Another patient who when sitting usually had to be helped to stand, was knocked down and in his resultant anger got upon his feet without help and thereafter was able to accomplish this act by himself.

An obvious criticism may be urged against accepting some of these facts as indicating recovery after cerebral destructions, because we have not had the opportunity of examining the brains. In the cases of gunshot wounds of the head such a criticism cannot be considered because knowledge is at hand of the cerebral destructions. Moreover one of the reëducated cases to which I have referred in a previous part of the paper has died and the examination of his brain revealed a complete destruction of the so-called motor cortex, with the lesion extending almost into the ventricle. In this case also, microscopical examination of the spinal cord shows what appears to be a complete degeneration of the crossed pyramidal tract.

A sufficient number of the elementary facts have now been placed before you to show (1) that although there is a general dependence of mental states upon the state of the brain, there is also (2) not the defined dependence of a special mental state upon the integrity of certain special cerebral parts. Whenever there is a disturbance of the cerebrum, there is an alteration of mentality. But even though the cerebral disturbance is a permanent damage or destruction, there is no certainty that the mental disturbance will be permanent. These are the points of the present paper.

My purpose in selecting this topic was not only to place before you some facts which are interesting in themselves, but also to call them to your attention as an indication of research possibilities in physiological psychology. A number of years ago Yerkes wrote that "such vague, general and probably inaccurate statements as those which are made in almost all textbooks which deal with this subject . . . are valuable only as emphasizing our crying need of facts in physiological psychology." The need is even greater today.

Clinicians have rather generally been satisfied with the collection of those facts that are important for diagnostic purposes. Psychologists have in general been satisfied to accept, mostly without doubt or due criticism, those neurological clinical facts that have been presented to them. Some neurologists have waked up to an appreciation of the necessity for finer examinations and for greater analyses along psychological lines, and it is to be hoped that psychologists will not hold themselves aloof from this field. Both can, and should, coöperate in the advancement of our knowledge along those lines which deal with the bodily mental relations.

THE MISUSE OF INSTINCT IN THE SOCIAL SCIENCES

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There is sufficient agreement at the present time as to the meaning of instinct to permit of a definition. Practically all English speaking psychologists reject the continental practice of considering it as any automatic action pattern, whether acquired or inherited, and limit it to those definite stimulus-response processes or action patterns which are inherited. This limitation to hereditary action-patterns is not, of course, identical with the term 'inborn' processes. The point of birth is nine months subsequent to the point of fertilization, at which the combination of hereditary characters takes place in the individual newly beginning life. During this intervening period many traits, which appear as automatisms at birth or for which the ground work is then laid, are acquired. An instinct is not only an inherited action pattern, but it is also definite. It is a specific response to a specific stimulus or set of stimuli.[1] One can not inherit an abstraction. Inheritance is either of concrete organs or tissues or of combinations of such, that is, of structures which determine the patterns of actions which inevitably proceed from them under unmodified conditions. These patterns of action, thus determined by the inherited organization of structures, we call instincts. Strictly speaking, one cannot inherit activities, but one may inherit the structure, the functioning of which determines the action pattern. This is our justification for speaking of the inheritance of instinct.

But action patterns can also be determined by acquired organization and functioning of structures. Practically all of the skills are such acquired or synthetic organizations of structure, functioning in different or more complex ways than

[1] Instinct as here used includes the reflex.

those to which inheritance directed them. Where such acquired or superinduced organizations of structures and functions occur and become automatic we speak of habit instead of instinct. Such modification of the organization of inherited structures, creating acquired action patterns or habits, occurs but slightly or seldom among the highly standardized basic structures of the human organism. In the bony structures it occurs directly scarcely at all, although the skillful surgeon may accomplish something here by way of modifications. Likewise in the visceral and glandular tissues and structures there is relatively little modification of functional organizations throughout life, although there are exceptions to this statement. The digestive system, for example, may adapt itself successively to different foods or even in extreme cases to narcotics and poisons with a high degree of success, and the glands are probably constantly undergoing minor and sometimes major changes in structure and function in disease or as a means to protecting the whole organism against a dangerous infection or a condition of strain. Other visceral functions and the structural organizations upon which they are based, such as breathing and the circulation of the blood and to a less degree the functions connected with sex, remain pretty constant throughout life. Consequently, we rightly regard these fundamental structural and functional organizations, which remain much or wholly the same throughout the life period and which are so basic to the life of the individual and the species, as mainly instinctive. They retain their inherited form with a minimum of change until the death of the individual.

But when we consider some of the more flexible and phylogenetically less basic structures and tissues of the body we find that they undergo a considerable modification of general structural and functional organization with the passage of time, and particularly in the first years of life, including the prenatal period of development. Even the minor and peripheral neuro-muscular controls—not those most basic to the evolution and survival of the type, such as those of the heart and those used in breathing—undergo a considerable modification in their collective or functional structural organization. We are born with few skills in the neural structures which control these peripheral muscles, probably largely because of our long history of parental care through a prolonged period of infancy; but we acquire a vast multitude of such skills or functional organizations of structures under the pressures of modern civilization or the complex social environment which we call civilization. These acquired skills—although they may have instinctive foundations of a rudimentary and often imperceptible sort—are properly called habits. The historical process of evolution, out of which the instincts developed by means of natural selection, had no need of such skills, and they were consequently not selected into the organism by heredity. But our multiplied problems of organic adjustment to the physical environment, which is constantly differentiated into ever-increasing complexity through the medium of our expanding social environment, calls for a vast mass of neuro-muscular technique which may continue in operation for only a few generations or even decades but which must be spread abroad throughout the population almost simultaneously. Consequently these skills cannot by any manipulation of Mendelian inheritance be made to appear and become generalized throughout society through heredity. They must be acquired; they are habits.

An even more flexible part of the organism which lends itself to the formation of an infinite number of acquired functional organizations of structure is the brain. It would seem that the chief function of the flexible brain is to provide an organism, which has become fairly definitely set in its fundamental or basic vital and visceral structural organizations and can no longer modify them easily to fit new and ephemeral environmental conditions, with a mechanism for making multitudinous and rapid and, especially, most intimate and detailed adjustments to a highly complex and kaleidoscopic environment such as is created in and by the development of a social or rational world. For this reason the brain is the least set or permanently organized portion of the organism. Our neural stimulus-response processes or action patterns are connected up after the point of fertilization, that is, after our heredity is organized or predetermined; and billions of these connections remain to be made even after birth. Even though we recognize the fact that vast numbers of these neural connections are made in carrying into effect the hereditary organization of the newly organized life cell at the point of fertilization, we must also recognize that, as soon as the environment begins to operate upon the growing organization of cells which constitute this new individual, the inherited adaptations begin to be modified and new connections are increasingly made to carry the environmental pressures or determiners into effect in action as the power and complexity of the environment increase for the individual. At the point where the environment has multiplied most largely its direct effects upon the individual, where he has established with it direct contacts through the media of language, custom, tradition, public opinion and the acquired muscular adaptations to his physical world, the influence of the hereditary determiners has become more and more indirect because their operation has been increasingly and repeatedly modified by interrupting environmental factors which build up substitute or modified neural response process connections in the cortex. Thus the brain, with its billions of neurons and the almost unlimited opportunity for acquired action-pattern or thought-pattern connections or combinations to be made within the cortex, becomes the chief region for habit formations. Here least of all—if at all—do we find developed the instinctive form of action.

The theory of innate or inherited ideas or images has been abandoned and relegated to the poetry of the mystics. Ideas and images are the product of acquired functional organizations of neural structures or habits. Likewise are our social and ethical ideals or values the result of such acquired organization. These last differ from ideas only in the complexity of the functional neural organization, permitting of a comparison and contrast of idea and imaginal units within the valuational complexes which we call social and ethical. To speak of instinctive ideas is manifestly absurd. To call ideals or social and ethical values, negative or positive, such as goodness, criminality, democracy, or conservatism, instinctive or inherited is therefore manifestly unjustifiable. Such an employment of instinct can persist only among those who have not yet analyzed the processes by which action patterns are built up. The fundamental problem of the social sciences, which have grown out of the attempt to adjust man to his social environments, is therefore to work out the mechanism by which new and non-instinctive action and thought patterns are built up to mediate these adjustments of man to the social environments which the social sciences undertake.[1] The problem of the present article is not so ambitious as the one just stated and is confined to showing how and why the role of instinct has been overemphasized in the social sciences in recent years. Such a task is urgent in itself in order that those who are working in these subjects may not go farther afield in search of false but seductive leads.[2]

There are various forms of the misuse of instinct in the social sciences. One type, which is literary rather than pseudo-scientific and is found in particular among the poets and in belles lettres generally, but also among the technical writers, consists of such terms as 'instinct with perfume,'[3] 'instinct with life,'[4] 'instinct with heredity,'[5] 'instinct with the breath of heaven,'[6] and 'instinct with the spirit of hate.'[7] This use of the term has no hereditary significance whatever, but is merely a metaphorical way of saying that an object is filled with some prized quality. The most serious confusion, however, is the one mentioned in the preceding paragraphs,

[1] The writer expects to pursue this subject further in fulfilment of obligations for an Amherst Memorial Fellowship for research in social institutions granted him for the year 1921–1922.

[2] See especially the entertaining but inconclusive attempts in this direction in Taussig's 'Inventors and Money Makers,' and Carleton Parker's 'Motives in Economic Life' in the reports of the American Economic Association and the American Sociological Society for 1917.

[3] Maeterlinck, 'The Life of the Bee,' p. 304.

[4] Bryant, 'A Winter Piece.'

[5] Starch, 'Educational Psychology,' p. 24.

[6] Pares, 'Russia and Reform,' p. 92.

[7] *Nation*, 108: 313.

where the functioning automatism is not distinguished as to origin, any relatively fixed or definite action pattern being pronounced an instinct whether it is acquired or inherited. If all that the writer or reader meant to convey by such an employment of the term instinct (as seems to be the case with some continental and a few American writers in social science) is that the act is performed without reflection or consciousness of purpose or previous plan, little harm would in most cases be done. For example, if by saying that people are 'instinctively protectionists' [1] or by speaking of 'instinctive truth-telling' [2] the writers mean that certain people are protectionists or truth-tellers by habit, and if the reader understands such to be the sense of the expressions, it cannot be said that harm is done, although little may be gained in the way of closer definition of subject matter or technique from such indefinite employment of the term. However, the writer often confuses both himself and the reader by such vagueness of speaking, for he may at one time mean only to emphasize the automatic character of the act and at another he may fall back upon the recognized or approved meaning of the term, implying that the automatism is an inherited action pattern. Especially is there such danger of confusion to both reader and writer in the latter of the two expressions above and in such expressions as 'instinctive regard for law', [3] or 'the instinctive conservatism of the propertied,' [4] or this striking instance: 'Jefferson's instinct to keep the government close to the people.' [5] These are functional qualities, based upon highly complex organizations of acquired neural connections or structures and cannot be inherited, but must be acquired from experience. Yet it would be easy to cite several hundred similar instances of confusion in the employment of this term from a collection made by the author of

[1] Taussig, 'Principles of Economics,' I, 513; II, 267.
[2] Ellwood, 'Sociology in Its Psychological Aspects,' p. 223.
[3] Wilson, W., 'Division and Reunion,' p. 172.
[4] Ross, E. A., 'Principles of Sociology,' p. 506.
[5] Vrooman, F. B., 'The New Politics,' p. 243.

this article, many of them drawn from some of the leading writers of the day in the social sciences.[1]

This vague employment of the term instinct finds its logical reductio ad absurdum in the application of the term to well-developed habit complexes, such as the 'instincts' listed in the classification in McDougall's 'Introduction to Social Psychology' and the various books on educational psychology of recent years. The most cursory analysis of the origin of the action patterns involved in such so-called instincts as the parental instinct,[2] reproductive instinct,[3] fighting instinct,[4] instinct of self-preservation,[5] the gregarious instinct,[6] and the like will show that by far the majority of the action content is acquired. Most of what a parent does for a child is the product of racial or individual experience and therefore belongs to the category of acquired habit rather than to that of inheritance or instinct. The same is true of the content of the other so-called instincts mentioned in this paragraph. To characterize such habit complexes as instincts implies either the abandonment of the accepted and desirable

[1] For some years the writer has been collecting and tabulating examples of the use of instinct in various fields of thought, the collection now numbering several thousand examples.

[2] Ellwood, 'Sociology in Its Psychological Aspects,' 213, 241; Coe, G. A. 'Psychology of Religion,' 94; Hayes, E. C., 'Introduction to the Study of Sociology,' 214; Kidd, B., 'Social Evolution,' 315; Kirkpatrick, 'Fundamentals of Child Study,' 46, *passim* (22 times); McDougall, 'Social Psychology,' 66, *passim* (28 times); Pillsbury, 'Fundamentals of Psychology,' 425; Shand, 'Foundations of Character,' 38, *passim* (11 times); Wallas, 'The Great Society,' 39, *passim*; etc.

[3] Conklin, E. G., 'Heredity and Environment,' 322; Hayes, *op. cit.*, 46; Kirkpatrick, *op. cit.*, 46; McDougall, *op. cit.*, 266, *passim*; etc.

[4] Ellwood, *op. cit.*, 216, 217; Hall, G. S., 'Adolescence,' I: 358; Kidd, *op. cit.*, 42; Kirkpatrick, *op. cit.*, 40, *passim* (9 times); Ross, *op. cit.*, 44, 606, 677; Starch, *op. cit.*, 420; Taussig, 'Principles of Economics,' II, 334; Thorndike, 'Original Nature of Man,' 68, *passim*; Wallas, *op. cit.*, 43, *passim*; etc.

[5] Blackmar and Gillin, 'Outlines of Sociology,' 232; Conn, 'Social Heredity and Social Evolution,' 249; Bücher, 'Industrial Evolution,' 1, *passim*; Crile, G. W., 'Man—An Adaptive Mechanism,' 38, 45; Durant, W., 'Philosophy and the Social Problem,' 147, 378; Ellwood, *op. cit.*, 216; Kirkpatrick, *op. cit.*, 92, 107; Shand, *op. cit.*, 182; Trotter, 'Instincts of the Herd in Peace and War,' 12, *passim*; Veblen, 'Theory of the Leisure Class,' 42, 110; etc.; etc.

[6] Durant, *op. cit.*, 161; Ellwood, *op. cit.*, 221, 290; Hayes, *op. cit.*, 214; Kirkpatrick, *op. cit.*, 119, 125; McDougall, *op. cit.*, 84, *passim* (16 times); Ross, *op. cit.*, 45; Sumner, 'Folkways,' 212; Trotter, *op. cit.*, 41, *passim*; Wallas, *op. cit.*, 39, *passim*; etc.

definition of instinct as stated above or a failure to analyze the structure of the acts involved. An instinct, since it is as much a unit character as any other product of Mendelian inheritance, is inconceivable apart from the fact of its structure.

However, there are many, psychologists as well as social scientists and others, who do think of the term instinct in such a vague and indefinite manner. They look upon it as a mystical something, variously denominating it as a 'tendency' or 'urge' or 'motor impulse' or 'quality of the act,' etc. Their thinking is metaphysical and animistic rather than scientific. They have either come to the social and mental sciences by the way of the vague and resonant categories of metaphysics and *a priori* logic and have remained untouched by the biological foundations of these sciences which they profess, or they have failed to grasp the true significance of the Mendelian theory for the social and mental sciences as well as for biology. Those who would admit that the total set of acts included under the terms 'fighting' or 'self-preservation' as applied to activities in the modern world are predominantly acquired rather than inherited may still erroneously believe that such a set of acts is instinctive because it is the result of some undefined 'tendency' to act in that way. Or they may claim that the habit complexes 'fighting' or 'self-preservation,' have original instinctive 'cores.' Or they may believe with McDougall that the habit complex is developed around an emotion and its derivative sentiments and that the emotion is the central and unchanging element of the original instinct from which the act takes its name.[1] Or, finally, the writer may have no clearly defined notion of how he may justify calling a habit complex an instinct but he 'feels' that the habit complex is 'dominated by' instincts or 'grows out of instincts.'

This claim that the habit complex, often miscalled instinct, is dominated by instinct in its formation will be examined in a later paragraph. The other assertion, that the habit complex is built upon an instinctive foundation, is of course in some

[1] *Op. cit.*, 33, 46.

sense always true, for all acquired action patterns must grow up as the differential phase or superstructure of inherited capacities and activity bases. But such a relationship of derivation, often very indirect and distantly connected in its nature, by no means argues an identity; nor would it be worth while asserting this fact if it were not so often urged in good faith and with all seriousness. The argument for calling an acquired complex an instinct on the ground that there is a 'tendency' to act in that way reduces upon analysis to the same proposition. A 'tendency,' which is not a purely metaphysical and mystical adumbration, must clearly be a neural disposition or set of neural processes. Such a neural disposition, if inherited, can be no more than the instinctive basis of the habit complex, often quite minute and remote and therefore frequently unrecognizable, in the final complex acquired activity organization. Most of those who explain the leap from real instincts to pseudo-instincts or habit complexes on the basis of an imputed 'tendency' are merely mystics. The others have not yet analyzed their proposition to its logical consequences.

The argument of the 'core' is essentially of the same character, unless indeed it resolves itself into that of the central emotion or the argument of dominance of the habit complex under the influence of a powerful constituent instinct. An example of this last type of argument may be found in the justification of the employment of the term 'reproductive instinct' (really a complex of instincts and acquired habits) on the ground that the complex is formed under the dominance of the powerful 'sex instinct,' which by the way is—as ordinarily used—a complex of various sex instincts and habits in which the truly instinctive maturation and expulsion of the seminal fluid by the male and equally instinctive action of the uterus and ovaries in the female may possibly be regarded as central if not dominant in the complex process. But there is vastly more to reproduction than these acts and these acts may take place without resulting in reproduction. The so-called 'maternal instinct' may be taken as an example of the former assumption regarding the 'core.' Here, following McDougall and others, the 'tender' emotion is central and dominant and is characteristic of the 'maternal instinct,' hence it builds up around itself all those acquired activities into a child-caring complex which are necessary to its satisfaction. This argument would seem to be equally mystical. This 'instinct,' with its unchanging central emotion, is purely an assumption and is not defined at all by McDougall in terms of its original structure (as all instincts must be defined) but rather in terms of its highly sophisticated functioning in every day civilized life. This amounts to defining a hypothecated instinct and accompanying emotion in terms of its modified expression in use under the pressures of a highly artificial environment, a procedure which is just the reverse of the accepted methods of inductive generalization. It is nothing less than mystical apriorism.

The assumption of an original and unchanging characteristic central emotion, which is the essential attribute of the instinct, is itself without foundation in the data. The fact is that every action pattern which fails to function with perfect automaticity develops some sort of emotion or other mental expression which is characteristic of the act performed or attempted. But a purely instinctive action pattern, functioning without interruption or hindrance, should develop no consciousness and therefore should be without a characteristic emotion such as McDougall insists upon. However, when the inherited action pattern or instinctive functional organization does not work smoothly because of the interrupting pressures of the environments—and in our modern complex civilized world, where the environment modifies and dominates practically every original tendency, it is probably impossible for any instinct to function with complete automaticity—consciousness, including emotion, enters into the process in proportion as the original activity process is interrupted or distorted by environmental pressures. Consequently, the less instinctive an act is the more emotion or other mental expression it is likely to develop. The complex habit dispositions should therefore have more emotional content than any constituent instinctive element, or, for that matter, than any constituent well established acquired automatism. If the quantity of the emotion is determined by the degree of environmental interruption or the necessity of making an adjustment in process of expression, the quality of the emotion is equally determined by the functional content or direction of the emotion, that is, by the character of the acts performed. It is not necessary that these acts be instinctive in origin. In fact, the origin of the act, whether inherited or acquired, has nothing to do with the determination of the quality of the emotion. The structure and the quality of an action pattern, provided it mediates the same adjustment process, remain unchanged regardless of whether the action pattern is inherited or acquired. Habits and instincts do not necessarily differ in mechanism, except where they are organized in the service of different functions, nor do they differ in degree of automaticity, except where environmental pressures bear upon them with different degrees of intensity, which are causes of variation wholly apart from the nature of the action patterns themselves. They differ essentially only in their origins. The quality of the emotion, which is the sign of interrupted adjustment, is characterized by the function it is serving and not by the origin of the action pattern with which it is connected. These conclusions would lead us to deny McDougall's assumption that a habit complex is an instinct or the creation of an instinct because of a central characteristic emotion, and to affirm, following the James-Lange theory of emotion in its main outlines, that the emotion springs up essentially in the process of habitualization of an act and proceeds from the process instead of creating it. It is the result of the weakening of an instinct rather than of its dominance.

This line of argument leads us to deny some further implications of certain highly sophisticated types of definitions of instinct. For example, the claim of some authors[1] that instinct involves a conscious element is clearly untenable. Such writers have lost sight of instinct as it appears in its purest form in the lower animals. Among men the instincts

[1] McDougall, *op. cit.*, 29; Pillsbury, *op. cit.*, 421 ff.; and many others.

have become largely distorted by the lengthening period of infancy and by man's increasing susceptibility through his highly flexible cortical processes to environmental influences —most of which he has himself accumulated as social habits through a long period of social evolution—with the result that many of the instincts which function intact in the lower animals are merely vestigial in man or have become broken up and detached from their former places in the developmental process as a whole and reattached to some particular section or aspect of it. The result is that man has come to be primarily dependent upon his social environment for guidance in the building of his action patterns, and, since that environment changes constantly and rapidly, it is inevitable that there is a large element of consciousness in most human acts which are at all complex in character. The failure to recognize these facts, of the vestigial or delayed character of many human instincts and of the large element of consciousness necessarily involved in human conduct, is alone responsible for the inclusion of consciousness of stimulus and of end in the definition of instinct.

No more is it proper to speak of purposiveness as essentially characteristic of instinct. We customarily regard any activity which serves to adjust the organism to its environment as purposive. If consciousness of the end enters into the act the purposive character is even more evident. But the attribution of purpose is in no sense dependent upon the origin of the act. As with the emotional content, the sense of purpose is dependent alone upon the functional nature of the act. Consciousness of the end being characteristic of the most highly developed purposiveness in action, we may say on the basis of our previous argument that habit adjustment or acquired action patterns have a higher degree of purposiveness than have instinctive acts. Similarly erroneous is the claim[1] that instinct is to be defined in terms of the function of the act. The function of the act has no necessary relation to its origin. All acts have some functional significance in the scheme of things. Nor does the fact that an

[1] Pillsbury, 'Fundamentals of Psychology,' 422 ff.

act is pleasurable signify[1] that it is instinctive in origin. Investigations into the neural correlates of feeling show conclusively that feeling is the function of the organization of the act and not of its origin, except in the negative sense that instinctive acts would not normally be unpleasant under natural conditions. But under the artificial conditions of civilization they may easily give rise to unpleasantness, while acquired action processes are often the sources of the highest if not of the intensest pleasures.[2]

So much for the analysis of the current misconceptions of the nature of instinct. In this discussion it has been pertinent to refer to the psychologists almost as often as to the social scientists, which is fitting, because the latter have largely copied their understanding of instinct from the former. In fact, both groups fell into their error about instinct quite naturally as a result of the old biology which was dominant at the time most of the authorities on instinct received their 'set' in thinking on this matter. When they studied biology the theory of the inheritance of acquired characters had indeed received its death blow at the hands of Weismann and others, but the new views had not yet so thoroughly permeated the backgrounds of their thinking, and of thinking in general, upon inheritance that they were enabled to divest themselves of the old preconceptions about what sorts of things are inheritable. Even when the Mendelian theory did become generally known in 1900 and in the decade following, it did not at once dissipate antagonistic ways of thinking. In fact it has by no means done so even yet. It is one thing to master a theory and a very different matter to reorganize one's ideas and reclassify one's knowledge and preconceptions in keeping with it. Very few people ever do the latter with anything like adequacy, if they have already made a pretty thorough adjustment to a science before an epoch making theory appears in it. An illustration of this sort of discrepancy is afforded by the following definition of heredity:

[1] *Ibid.*, 431, 441.

[2] Cf. Meyer, 'The Neural Correlate of Feeling,' Psychol. Rev., 1908, 15, 307 ff.; Bernard, 'Transition to an Objective Standard of Social Control,' Chs. 2 and 3.

"By heredity is meant the degree of likeness between parents and offspring."[1] Although this definition was written by the professor of zoölogy in the University of Birmingham eleven years after the dissemination of the Mendelian theory, which must have been known to him, it would be difficult to select another definition so inadequate to Mendelian principles.

We are only beginning to square our psychology and our sociology, on their genetic sides, with Mendelian principles of heredity. The old theories of instinct are essentially Lamarckian and Galtonian, and even metaphysically vitalistic, in their accounts of derivation. The new theories of instinct, which recognize an instinct as a concretely definable unit character in the Mendelian sense, must be developed by students who come directly to the mental and social sciences with the Mendelian and Weismannian hypotheses and the newer biochemical and biophysical biology without the disturbing penumbra of the older views of heredity and metaphysical and vitalistic biology which have not been thoroughly extirpated from the thinking of the present generation of scientists.

Viewed in this light, activity complexes, such as were described above, can no longer be called instincts. Their acquired content becomes too obvious. The actual instincts are at once much simpler and more elemental and much more numerous than those set forth in the classifications of such writers as McDougall,[2] Thorndike,[3] and other psychologists. There are probably hundreds or even thousands (if we include the reflexes under the general heading of instinct) of these inherited mechanisms, mainly overlooked by the casual observer because they do not ordinarily function as independent units in adjustment processes but rather as constituent elements in larger habit complexes developed in response to environmental pressures.[4]

[1] Gamble, 'The Animal World,' 1911, p. 230.

[2] *Op. cit.*

[3] 'Original Nature of Man.'

[4] See Shand, 'The Foundations of Character,' for examples of how some of these supposed complex instincts may be broken up into simpler elements.

It is true that these habit complexes are built upon these elementary and relatively minute instinctive bases, but it does not necessarily follow that any particular habit complex is built directly upon any particular instinct or group of instincts. If we liken habit to a building which is reared upon a foundation constructed of stones to correspond to the instincts, we may compare various constituent habit complexes to the successive stories in a skyscraper. Some habit complexes are low down upon the bed rock of instinct, while others are near the top of the building and have only very indirect contacts with the basic instinctive tendencies. It is also well to recognize that in our modern civilization these skyscrapers of habit are sometimes built very tall. Some men live lives which are relatively close to instinct, while other men build story after story of culture and sublimated interests until instinct is scarcely discernible in them in its original forms. Each successive story of habit formation is built upon the next story below and not upon the native instincts at the base, although even the most cultivated man may, under the stress of great crises or fear or illness, descend into the basement of the structure of his character and for a time live on a level with his instincts, forgetting his better and acquired nature.

Modern civilization is like a city of such skyscrapers. Organized into blocks and sections of this city, facing along certain streets, which we may liken to the avenues of custom and tradition, of public opinion and convention, they collectively constitute the tremendous social environment divided functionally, if not geographically, into institutions. As each new individual comes into the world he has much the same foundation as others have of native soil upon which to build, varied to be sure here and there by excavations, marsh land, hill, or stone; but whether this individual grows into a towering skyscraper, a dingy tenement house (like some erudite but confused scholars!) or is arrested in his development as a shanty in the slums, depends not so much upon the character of the soil, as defined above, upon which the superstructure is reared, as upon the environment in which it grows. Just as the character of the building on lower Broadway will inevitably differ from that of the Bronx or Flatbush or Hoboken, so will the human character vary according to and in response to the social environment, the native soil or instinct exercising a deciding influence only when its character is so markedly exceptional as to make the usual structure suited to that environment manifestly impossible.

While the above description is in the nature of an analogy rather than an analysis of the concrete activity processes connected with the development of character, I believe the description is essentially true to the facts. The instincts are very early overlaid by acquired habits in the process of adapting the individual to his environment, and these habits are in turn overlaid by other tiers or stories of habit in which the native character of instinct ever constantly diminishes in proportion and intensity, until the child who has reached a rationalizing age is reacting in nine tenths or ninety-nine one-hundredths of his character directly to environment, and only in the slight residual fraction of his nature directly to instinct. The influence of environment is cumulative in our lives and the decay of the influence of instinct is progressive.

Other evidence that instinct does not dominate habit formation is to be found in the fact that the extension of the period of infancy in man has distorted the growth process so far as the instincts are concerned and has substituted to a large degree the active care of the mother for the guidance of instincts in the child's development. As a result, some of the instincts which function completely in the lower animals, such as walking and running and the making of definite movements connected with food-getting, have been rendered largely vestigial by the substitution of the mother's providence. Other instincts, such as those of sex, have not been rendered vestigial but have been torn from their moorings in connection with the early stages of the growth process and have been attached to a particular stage of development farther along. These may be called delayed instincts. The former class of instincts tend to drop out of the developmental process altogether, or to be broken up into their constituent reflexes which are now reorganized around other functional activity processes—mainly habit complexes,—or they are so modified by the developmental process, controlled by parents and community, that they never appear in their original form or in complete maturity.

The same modification of the original action pattern by environment happens, to a less degree, in the case of the delayed instincts. Already, before they appear, the organism has developed such a large complex of habit adjustments to the environment, which are so far in advance of the adjustments which the lower animal forms make to the environment, even after these instincts have appeared in the developmental process, that the now delayed instincts come into action in the higher life forms in combination with a different set of functioning activities from that which historically they are adapted to. Consequently they undergo modification, either in structure or in organization, from the inception of their development. Thus the sex instincts in man do not appear in an organism possessing simple and unsophisticated activities and without learned sex attitudes and moral preconceptions, as would be the case in much lower life forms, but they begin to function in a being who has already a set of habit controls, especially adapted to his civilized environment, called 'sex morals.' He has also learned a wide range of vocational and æsthetic activities which compete in the expenditure of energy and time with the sex impulses. Also, and a matter of the greatest importance, this sophisticated animal has learned to wear clothes, which fact serves in numerous ways to inhibit the stimuli to the instinctive activities of sex. In this way the sex life has been conditioned, almost set, before the sex instincts appear. As a consequence, most of man's sex life is learned and is hemmed about with modifications and transformed with sublimations and perversions. Because the basic inherited physiological processes of sex—the true sex instincts—are necessary to the perpetuation of the race they remain intact instead of becoming vestigial, as is the case with instincts for which the acts of another can be substituted in the developmental process.

But, none the less, their functioning—the extent of their exercise and the direction or application which they take (whether in adaptation to reproduction or to amusement or to more decided, even commercialized, perversions)—depends upon the controls—largely antedating their maturity—which have been developed in man's social environment. Even they, although intact in their elementary forms, do not control the environment of habit, except in a diminishing and minor degree, as civilization advances. The vestigial instincts control habit formation in even a less degree; are in fact being destroyed by the accumulated force of environment functioning in their stead, better to meet the contingencies of an ever more complex and more rapidly changing world.

This view that instinct in the human type is being disintegrated by the encroachment of habit, aided by the vestigial and delayed character of many or most of the instincts, consequent upon the extension of the growth period, may be objected to and the contrary argument advanced that man has more, rather than fewer, instincts than the lower animals. Such has often been asserted[1] and recently definitely denied.[2] It seems very unlikely that the human animal is in process of acquiring new instincts; certainly not such complex ones as the less critical psychologists attribute to him. There are a number of significant facts which contradict such an assumption. In the first place, the mathematical laws of chance are against it. An instinct as complex as the 'maternal' or 'gregarious' or 'rationalizing' instinct, involving as it would in the aggregate of some millions of neural connections or processes (for there must be at least so many neural dispositions for each of these class terms or 'instincts' as there are ways or combinations of ways in which each of the groups of functions represented by these terms may be carried on), would appear as a spontaneous mutation (never, of course, as inheritance of acquired traits) with just the proper organization to fit the requirements of the environment of that particular time and the place, in some

[1] Cf. William James, 'Psychology,' Ch. 24.
[2] Cf. Miller, 'The Psychology of Thinking,' 76–77.

highly fortunate individual, only once in an age. The statistician would not expect to see such an instinct crop up in large numbers of the population in a single generation. Take, for example, the rather wide spread abilities of the Italians to sing and to appreciate grand opera. Often these abilities are said to be inherited. They are extremely complex, consisting of a manifold technique of muscle, vocalization, symbolization, etc., in which perhaps tens of thousands of neural connections of a very definite order and organization are involved. It does not seem likely on the basis of the laws of chance that the highly complex ability or 'instinct' to sing grand opera would appear spontaneously in so many thousands of Italians since 1600, whereas it had never appeared at all even among this musical people before that time. It seems much more likely that, living in a musical environment and aided by the inheritance of organic structures of the inner ear which make pitch and tone discrimination easy for them, they have learned instead of inherited the highly complex content and technique of their art. If one can learn Greek or Sanscrit, although one has no Greek or Hindu blood in his veins, hence no conceivable heredity for these languages, might he not also learn grand opera, especially if the environment is favorable to this acquirement? Or, shall we suppose that only those who have a spontaneous mutation for Greek and Sanscrit and grand opera can learn these languages or execute this type of music? The proposition becomes absurd. Yet it is not unfair to the assumptions of those who speak of complex social instincts which consist of activity complexes unknown to earlier generations and which therefore must have been organized but recently. The so-called instincts of democracy (conceived as functioning in the modern socialized state), of fighting (when applied to modern scientific warfare), or of gregariousness (if meant to include the multifarious forms of modern intercourse) are examples in point. If we always remember that there can be no instinct apart from its structural and activity content, that it is never a mystical 'entity,' 'tendency,' 'influence' or other indefinite mask for ignorance, but always a concrete reality, in the last analysis biological in its nature, there will be no occasion for supposing that such recently organized complex activities or highly fluid and changing classes of activities could appear as mutations in a great number of people in a short period of time, if at all.

But, for the sake of argument, let us suppose that a very few people might be blessed with a spontaneous mutation which gave them the power to execute grand opera, or any one of the complex 'instincts' such as the recent social and educational psychologists impute to us. How could these complex abilities be generalized to the whole population? Certainly it could not be done in a single generation, nor in ten thousand generations. The organization of society, with its taboos on race and class interbreeding, being such as it is, it is doubtful if such traits could ever be disseminated throughout the human race. Certainly for slow-breeding man the time element would be prohibitive for the rapid dissemination of new traits by means of heredity. And yet, most of the present-day content of the complex 'instincts,' such as fighting, mother-care, gregariousness, self-preservation, and the like, is not very old. Very little human fighting, for example, is any longer of the character engaged in by lower animals, but involves the most complex technique of manipulation of firearms, poison gas, field guns, map-making, field tactics and parliamentary wrangles, to say nothing of the journalistic sideshows. All of this, if instinctive—and nothing is instinctive about an 'instinct' if the concrete action content is not—must have been spread abroad throughout the world in a generation or two or three by biological inheritance! It would be remarkable, if true.

It will avail nothing to fall back upon a mystical interpretation of instinct, as a method of refuting these facts, claiming that it is the 'central emotion' or the 'tendency' which is inherited and that these come down from man's prehuman ancestors. This argument was exploded earlier in this article. An emotion is not a mystical entity, resting in some isolated corner of the brain, which dominates action much as the metaphysical or supernatural 'free will' was formerly supposed to do. Emotion is correlated with and characterized by the whole act which comes into consciousness in any degree, whether it is an instinctive or a habitual act. The isolated and unchanging central emotion of McDougall is a myth. Instinct is action according to a structural action pattern or it is nothing. To repeat, we do not inherit abstractions, but concrete biological organs and structures. Neither is our inheritance lateral, across generations from contemporary to contemporary, but longitudinal and differential, from generation to generation. Consequently we may conclude that if new instincts, complex and peculiar to man, were appearing they would not so quickly spread to the human race as they seem to do. Only acquired action patterns can be disseminated in this way.

The demand of the accumulated complex social environment, which we call modern civilization, is for an organism with a maximum of variation of activity at a maximum of speed. Only with such capacity for change can man make the most of his powers and reap the largest reward from nature's resources and society's riches. Only with such powers can man be so ubiquitous, adapting himself to all climes in quick succession, living under all the conceivable conditions which his interests dictate. The insect has a narrow locus and dies in the same season in which it is born, or it makes the transition by means of metamorphosis. Its instincts are practically fixed. If man was solely a creature of instinct he too could not enjoy his vast range of adaptability. It is because his completer or progressive development demands ever greater flexibility of adptation that he is shedding his instincts as he evolves and substituting for them control through the growing and self-perfecting institutions of his social environment. Man is able to dispense with instinct because he has a highly complex and well organized social environment, and in so far as this environment is improved and becomes more adequately organized to meet his present and future needs it dispenses with his instincts in the evolutionary process of selection or it represses and transforms them in the progressive character development of the individual. For man to be accumulating new instincts instead of losing or repressing and transforming old ones would work exactly contrary to his needs of adaptation to his increasingly complex and changing environment. The rate and mass and degree of change in this environment are already so great that his adaptations could not possibly be made on the basis of instinct alone or even primarily.

Are we not, then, in the light of these facts, forced to the conclusion that the complex social 'instincts' are in reality aggregates of habits, organized and reorganized from more elementary habits and simple constituent instincts, with reference to some specific function, the content constantly changing as the function and organization of the adjustment to be made vary? Although the content of the habit complex, miscalled instinct, varies constantly with the character of the adjustment, the aggregate of acts itself retains the same class name as long as it serves the same general function in society or for the individual. Thus, the habit complex tends to be named with reference to its function or according to its value—as maternal, gregarious, ethical, fighting—while the content varies infinitely, never consecutively possessing that unity of character which is essential to the concreteness of biological instinct. The class term for the group of fluid or changing acts is an abstraction representing ordinarily a social valuation, although it may also be named generically after the root type of structure to which it conforms. The explanation for calling the habit complex an instinct is sometimes the confusion of automaticity with inheritance and sometimes an inability to separate the total aggregate of activities from some prominent instinctive act which is included in it. Sometimes it is both. Both criteria are deceptive guides. Sometimes the resemblance between the total habit complex and the constituent or foundation instinct is more symbolical than real. Sometimes it represents the continuation of a name long after the habit complex, through growth in content and changed adaptation, has undergone a complete transformation of character and has lost its former resemblance to the instinct. This is markedly true of the so-called maternal instinct which, in content of activity in the human being, has only a few remnants of the original maternal instincts of lower animal types.

But there would be no conclusive objection to this misuse of instinct if it brought good results. Its results are not good, but disastrous. The method has so far been barren of aid either to the investigator, to the teacher or to the social reformer. The educational psychologies, like the social psychologies, start out with an elaborate analysis of the so-called instincts and then solemnly inform the reader that the task of the educator is to guide these instincts into fruitful development as a method of adjusting the child to life; that it is the function of the school to develop the instincts instead of repressing them. A recent textbook in this field[1] illustrates the point. The elaborate analysis of instinct in this work, however, is not followed by a fulfillment of its promise. Specific instincts are mentioned only a few times after the introductory chapters are passed, and in this respect the book is not exceptional. The process of applying the instincts to the living educative process turns out in most of these books to be a very general and vague one. And so it is in the social psychologies. The applications have little of the exactness which characterizes the definitions of instincts.[2]

This inability in practice to make the development of the instincts fulfill the promise of the classification is not, however, a matter to occasion surprise. The social and educational psychologists have started to build their superstructures of individual character and social institutions upon too sophisticated and too unstable units. These units (supposed instincts) will not retain their form and character under the pressures of environment in the socializing process. Their contents are too fluid and indefinite. It will be necessary to divest the 'instincts' of their acquired content and to reduce them to the most ultimate possible terms. Then the psychologist, the educator and the sociologist can begin to use them as building stones of character out of which to construct the foundations and part of the superstructures of social life. The exposure of the present incorrect usage of instinct should

[1] Starch, 'Educational Psychology.'

[2] Compare in this respect the two volumes by McDougall: 'Introduction to Social Psychology' and 'The Group Mind.'

clear the field for a vastly more important labor of analysis in character and society building.

The real task before the social and educational psychologists is to discover the mechanisms by means of which the child and the citizen build up their habits upon the basis of the instincts, directly or indirectly, and by means of which one habit or set of habits is transformed into another. Hitherto they have approached this problem from essentially the wrong angle, that of the analysis of instinct, on the assumption that instinct dominates the development of habit. Both the approach and the assumption are erroneous. The sociologist is demonstrating that the environment increasingly dominates both the content and the direction or functioning of habit formation. It is, therefore, from the standpoint of the character and the organization of the environment that the control of the growth of human character should be approached, the instincts being regarded primarily as the original—not necessarily the immediate—starting points in the process. But before this change in emphasis can be brought about the inadequacy of the theory of instinctive control must be made manifest through an exposure of the current radical misconceptions regarding the nature and content of the instincts. Many sociologists have been feeling their way toward this objective for some time. It is a task which of necessity falls to the sociologist, because only he has the data regarding social organization and social pressures in sufficient mass and detail to make the error of the biological group—generally quite uninformed regarding the complexity and dynamic character of the social environment—sufficiently evident. It is not too much to say that the future control of the human race and its civilization lies not through selective breeding of the higher social qualities—although selective breeding of those traits which can be so bred is of the greatest importance—but through their transmission by social contact and control.[1] The overwhelming—and generally the immediate—pressures upon the character-forming process, especially in its more advanced stages, comes from the accumulated social environment.

[1] Cf. Conn, H. W., 'Social Heredity and Social Evolution,' Ch. 11.

AN ATTEMPT TOWARD A NATURALISTIC DESCRIPTION OF EMOTIONS. (II)

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VI

The Utility of Emotional Behavior.—One of the effects resulting from the growing influence which biological theories began to exert upon psychology in the middle of the past century, was the conception that emotions are definite adaptational reactions which promote the conservation of the individual. More than closely linked is this assumption of the self-preservative character of emotional conduct with the idea that emotions are inherited forms of response. Not the least surprising, then, is the fact that the utilitarian doctrine of emotional behavior is more prescriptive than descriptive, and brings in its train results that are most remarkable.

It is entirely possible that even the most careful observer of emotional behavior may needs come to the conclusion that much of such action must be interpreted as adaptational and useful. In particular, this might be the case with the glandular secretions which are so prominent in emotional behavior. But what right have we to base our conclusions upon a limited number of features? What of the looseness of the bowels, the retching and vomiting, the violent heartbeat and the innumerable other symptoms of emotional shock? Are these too of use in the organism's adaptations? And is there anything in the nature of a psychological act which prohibits us from considering the glandular reflexes as entirely fortuitous occurrences in the total complex pattern of response?

Further indications of the invalidity of the utilitarian theory come to the surface when we consider that in the cultural emotions organic functions are not nearly so prominent, and apparently do not produce energy-giving secretions. And it is hardly convincing to say that in these secondary emotions the organic reflexes are not present because they are not needed, for by so doing one clearly makes utility synonymous with presence, and in consequence assumes what is to be established, since as a matter of fact even when the organic activities are present their utility is questioned.

Unfortunately the apparent serviceability of various strongly excited organic activities under certain circumstances has induced several writers to indulge in much indifferent speculation concerning the utility or general adaptive character of emotions.[1] Aside from the question whether these writers are observing emotions at all,[2] the objectionable feature of such speculation is the implication that organisms possess general mechanisms with definite purposive functions to meet unfavorable specific circumstances. The consequence of holding such a view is that it inevitably results in overlooking facts, such as the substituted character of the organic processes, which are not compatible with such a preconception.

The writer submits that, on the whole, observational evidence does not support the view that emotional disruptive shock is always or even in most cases beneficial to the organism, either at the moment or in the long run. As a record of fact, all that the study of emotions enables us to say is that under certain circumstances the emotional behavior is apparently a useful reaction in the sense that a very rapid and immediate response seems necessary, and it occurs. But, in just as many cases the dissociating and disruptive character of the emotional act may be the occasion for a very harmful result to the organism, and not infrequently the cause of its death. What chance would a person have in a difficult situation if he should be deprived even for a moment of the opportunity to offer a definitely centered and directed response to a pressing stimulus? It is evident, then, that

[1] Cf. Cannon, 'Bodily Changes in Pain, Hunger, Fear and Rage,' 1915. Note Cannon's hortatory defense of the martial virtues.

[2] Note the grouping of phenomena—pain, hunger, fear, rage.

emotional behavior is not always adaptable activity and consequently we must reject summarily any utility interpretation, especially since such an interpretation appears not to be based upon actual observation but upon the belief in a mental force or entelechy manifesting itself by physiological conduct.

VII

The Relation of Emotions to Instincts.—Current psychological opinion appears unanimously agreed that there is a very close connection between emotional and instinctive behavior. And the basis for the belief in such a connection lies in the observation that emotions are very direct and even elementary forms of behavior. It is only the fact of connection, however, that is concurred in, otherwise there is wide divergence of opinion concerning the precise relation between instincts and emotions. Thus, McDougall conceives of an instinct as a fundamental system of action including an emotion, whereas Shand thinks of instincts as being parts of the fundamental emotion.[1] In passing, we might suggest that the disagreement between McDougall and Shand is made possible by the fact that the distinctive feature of emotional behavior is a form of dissociation, a fact which makes possible differing views as to the specificity or generality of such psychological acts.

Still another disagreement between those who believe in the close relation between instincts and emotions concerns the exact stimulation of them to action. On the one hand, it is held that emotions are the affective accompaniments of instincts in some form (McDougall), while on the other, emotions are presumed to arise when there is delay or obstruction in the way of instincts toward carrying on their predetermined goal (Shand). Let it be noted, however, that in all cases the implication is forced upon us that our action is predetermined by some innate power. Now such a view

[1] All this for both in terms of mental structures. Cf. Shand, *Proc. of Arist. Soc.*, 1915, 15, 74. "Primary emotion is at first a biological force pursuing its innately determined end by means of instincts and other dispositions organized with it." *Ibid.*, p. 75.

of human activity is entirely incompatible with any observation of behavior and leaves no place for the development of action and the conditioning of it by specific surrounding objects and persons. Our activities are not as a matter of fact the unfolding of purposes and ends but the responses to stimuli and their settings as they actually are found in our surroundings. Because we have no instincts in the sense of biological ends there can be no connection between instincts and emotions; this connection is impossible also, because actual instincts as found in animals and infants are definite response-patterns called out by specific stimulating objects; they are not in any sense tendencies which can conflict with each other.

No less significant than brilliant was the formulation which Dewey[1] made of the relation of emotions and instincts. Let us recall that Dewey was interested in the problem of substantiating James's doctrine of the priority of the organic changes (expressions) to the emotion proper by a reformulation of Darwin's statement of emotions and their expression. The reader will recall that Dewey interprets Darwin's expressions as "the reduction of movements and stimulations originally useful into attitudes," attitudes which apparently are conditioned by instincts. For Dewey the specific seizure or affect in an emotional situation is a conflict and tension of instincts or tendencies to action. "The emotion is *psychologically the adjustment or tension of habit and ideal,*[2] and the organic changes in the body are the literal working out in concrete terms of the struggle of adjustment." [3]

For us the significance of Dewey's doctrine lies precisely in the fact that it glaringly reveals the inevitable consequence of injecting into psychology such metapsychological entities as instincts. For mark you, Dewey cannot allow that the person is stimulated by a concrete object, for without the inhibiting tension an organism would not be making a response 'at' or towards an 'object,' [4] and so the conflict of instincts takes

[1] Psychol. Rev., 1894, 1, 553; 2, 13.

[2] Apparently the conflict of two or more instincts brings about the emotion.

[3] Psychol. Rev., 1895, 2, 30.

[4] *Ibid.*, 2, 28.

place as a mysterious ebullition in 'consciousness' out of which are differentiated both the stimulus and the response.[1]

Obviously the theory we have been summarizing cannot be employed to interpret the concrete disruptive behavior of actual human organisms, but we are interested to point out that possibly this is true of all instinct doctrines. The idea that emotions are conflicts of instincts or result from the conflict seems to us purely fanciful; and being based on so-called inner states it is in consequence entirely out of touch with concrete reaction conditions. Such a doctrine makes of emotions in some sense the inner side of instincts, while the latter are presumed to be the external phases of certain acts. In all theories of the close or inseparable relation between emotions and instincts, the former are presumed to be 'mental,' while the latter sometimes are and sometimes are not.

But after all such a widespread conception as that of the relation of emotions and instincts must have some factual basis, and truly enough a diligent search is rewarded by the means to account both for the asserted relation, and the belief in a conflict of tendencies.

And first as to the relation between emotions and instincts, the writer submits that the mentalists arrive at their interpretation by miscalling the substituted reflexes, in the emotional pattern of response, instincts. The motive for such a misinterpretation may be sought in the utilitarian conception of emotions, according to which all that occurs to the person must be looked upon as necessary happenings and never as fortuitous processes.

The conflict theory of emotions no doubt is based upon the observation that in some emotional situations a seizure occurs in the presence of a multiplicity of confusing objects; so that a simple response pattern cannot function without interference. Now the crude fact here is a conflict between stimulus objects and the concrete responses of the individual in contact with them, such stimuli and such responses being

[1] "The frightful object and the emotion of fear are two names for the same experience." *Ibid.*, p. 20.

natural objects and events. From an objective standpoint it seems a far cry from this crude fact to a conflict of mentalistic states. An interpretation of concrete movements of an organism can never be made out to be a conflict of permanent mental tendencies.

VIII

The Classification of Emotions.—If we agree to reject the belief in the relation of emotions and instincts, we at the same time renounce the latest of the perennial attempts to classify emotions.[1] And perhaps here we find a clue to the failure of all those attempts to segregate emotions under convenient rubrics. The clue is this, that psychologists could not find any common factor between the complex behavior of an organism and a presumed mental state, a fact which is otherwise expressed in the statement that there is no definite subjectivistic criterion for the classification of emotions.

From an organismic behavior standpoint, there is strictly speaking, of course, but one kind of emotion; that is to say, emotions constitute a class or type of action. The most obvious means, therefore, of classifying the various emotional activities is to correlate them with the exact circumstances under which they occur, and while the extreme complexity of these stimulating circumstances militates against our attaining at present any well rounded and compact classification, such a correlation will serve to give some behavior-content and meaning to the various divisions. Moreover, to describe an emotional act under the circumstances in which it occurs is to give it its stimulus-response setting and to keep our classification from resembling an enumeration of specific faculties.

The problem of ordering and arranging emotional acts involves us in precisely the same difficulties as the classification of thinking acts. In each case, however, the specification of the exact circumstances under which the person is responding will give us an insight into the operation of human reactions, besides helping us to understand the precise details

[1] Cf. McDougall, 'Social Psychology.'

involved in building up reaction systems. For instance, a comprehensive behavioristic study of the more subtle or refined emotions will afford us some insight into the intricate details of social behavior and the social modification of human action. Further, unless we plan to make such a comprehensive study of emotional activity we can find little promise of obtaining additional information about such behavior by the mere analysis of the secretory functions which play a prominent part in emotional acts as well as in other types of behavior. More value there would be in such an analysis if we considered the glandular secretions as integral parts of a large general response system in correlation with definite stimulating circumstances. It is something other than scientific wisdom to place one's hope for the classification of emotional conduct entirely in the physiological factors of behavior, as some writers do, to the neglect of the other components, and the stimulating conditions of the whole response.

Of cardinal importance it is for the classification of emotional conduct to be fully cognizant of the fact that whenever we persistently cling to a name as though it were something more significant than a name, we will inevitably falsify essential facts. Perhaps in no other domain of psychological science does a name mean quite so little or do so much harm as in the study of emotions. It is not surprising, then, that the literature on the subject amply reveals many difficulties of description and interpretation because such terms as fear, anger, joy, and sorrow are presumed to represent unique sorts of psychological facts. The truth of the matter is, that these names as commonly used stand not only for genuine emotional reactions but also for various other acquired human responses, such as feelings, besides the connate organized responses of animals and infants. Furthermore, let us not forget that besides standing for widely different forms of actual behavior, the names found in the writings on emotions represent mental states, each of which has a variety of expressions. Because names are so treacherous in the psychology of emotions, the needs of the science dictate that a closer examination be made of the behavior which is to be classified, and that slighter attention be given to conventional names.

IX

Determining Conditions of Emotions.—Incomplete must always be the description of psychological phenomena unless we add to our report of the facts of stimulus and response also the conditions under which the latter interact. The necessity to investigate the precise conditions influencing responses appears from the fact that any reaction depends as much upon the constitution of the individual and the character of the surroundings as upon the bare presence or absence of reaction systems and stimuli. In the case of the emotional situation the disruptive chaos can obviously be avoided by the substitution of an overt response for one that is lacking, provided that the surroundings are propitious, and the person is in a prepared condition for such an emergency.

Although there is great difficulty in specifying the exact determining conditions of emotional conduct we can, however, isolate a few factors which have a contributory effect in bringing about or preventing an emotional reaction. We may call these constitutional and stimulating conditions, respectively, inasmuch as they refer primarily to the condition of the person or the surroundings.

1. Among the constitutional conditions we might enumerate the following. (*a*) The primary constitutional condition of emotional behavior involves the fact of psychological equipment. A person who is thoroughly equipped with response patterns for the various situations in which he finds himself will be decidedly less liable to be thrown into a situation of no-response. Further, the student who had previously prepared himself in his learning task would be much less liable to suffer a surprise emotion when confronted with a difficult examination. (*b*) Closely related to the previous condition is the speed of reaction of the person. Ordinarily an individual who is not quick to improve upon a situation confronting him will be liable to be caught in a dangerous or undesirable position. The person who would begin to act rapidly in the presence of a dangerous object, possibly to

inhibit movement, or to substitute another overt adjustment, would be much less apt to suffer disruption of his actions. The person who is clever at repartee will seldom if ever suffer an embarrassing moment. In this type of situation as in some of the elemental situations the self-confidence of the person is an extremely potent factor in the prevention of emotional disturbance. (*c*) The ability to avoid an emotional shock depends upon the general physiological condition of the person, since the capacity of the person to handle his reactional equipment varies with his physiological states. A person who is just recovering from an illness may be for the time being inadequately equipped to grapple with a dangerous natural situation. Similarly, to be overworked, nervous, or discouraged, means a special liability to undergo emotional shock. In these cases as in all others we must observe that the constitutional condition only has direct reference to the stimulations at hand. (*d*) Another influence of emotional conduct is the present condition of an individual which is due to the circumstances of an immediately preceding emotional situation. Thus the same or a similar stimulus may now influence the person not to suffer an emotional disturbance at all, or to experience a mild rather than a violent seizure.

2. The stimulation conditions of emotional behavior are very numerous as we might expect. (*a*) One of the outstanding conditions would be the familiarity of the person with the stimulating objects and their settings. When stimuli are known and not strange they are less liable to bring about a dissociation or disturbance in the person. One is seldom overawed or overwhelmed by familiar surroundings, and in a sense this is obvious when we consider that familiar surroundings mean that we have developed definite integrations of stimuli and responses. (*b*) Prominent as a contributory factor to social emotions is the presence of certain persons; a reproof or a *faux pas* in the presence of some relation, loved, or admired or feared individual will often result in an emotional behavior, whereas the absence of such persons may mean the avoidance of such a result. In general, the

emotional disturbance is conditioned by the setting of the stimulus object, so that while the person may know what reaction to make to an object alone or under certain circumstances he may have no response for the object in its present setting. (*c*) It follows then from the character of the conditions of emotional behavior that a potent preventive of emotional seizure is a frequent contact with any given situation and especially a situation which, through recent experience, has shown itself capable of inducing an emotional disturbance.

X

Emotions in Animals and Infants.—Throughout the entire modern subjectivistic tradition psychologists have always assumed that animals have emotions as well as other states of consciousness. Especially since Darwin's time, in which the continuity of species became the dominant motive in the biological domain, the view has prevailed that human emotions are really vestigial remnants of the emotions which the animal ancestors had acquired. Naturally enough such a mental states doctrine conduces to obliterate the distinction between emotional actions proper, and other types of feeling behavior, and as a consequence animals are endowed with reactions which, because of their organization and development, they, in common with infants, obviously cannot have. How anyone can ascribe to animals and infants such complex reactions as can only be acquired in a long social experience, is suggested to us in the thought that probably psychologists are reading back into the actions of children and animals motives and conditions of behavior which they find in themselves. How illegitimate such a proceeding is may be judged from the fact that a critical observation of the actual responses to stimulating circumstances convinces us not only that animals never have any social emotions, but also that they seldom if ever develop to the stage of performing even elemental emotional behavior.

Since the present status of psychological opinion concerning emotions in animals has its roots in the Darwinian influence upon psychology, it would not be amiss to digress at this point in order to trace out the growth of the conception that man and animals have the same types of mental states. And first let us observe that Darwin accepted the biological similarity between the human and animal organism as the basis for a correlation between the expressions of emotions in the two cases. What seemed to be similar 'expressions' were then taken to refer to similar mental states. What Darwin and the other writers overlooked in their thinking was that they were not observing expressions of any mental state but rather direct animal responses of an instinct sort to specific stimuli. They, however, named these responses by applying conventional terms,[1] and in this way animals began to be endowed with all types of emotions and other sorts of feelings. Finally, this mode of thinking developed to the extent that Darwin[2] could write that 'man himself cannot express love and humility by its external signs, so plainly as does a dog.' Clearly we have here as flagrant a piece of anthropomorphism as one would care to find, even in such a culpable writer as Darwin is in this direction.[3] An excellent example of Darwin's uncritical views concerning the psychology of animals is found in his acceptance of Mr. Bartlett's statement concerning the knowledge and cautiousness of hyenas. "They well know that if one of their legs were seized, the bone would instantly be crushed to atoms." What one gathers from such a statement as was just quoted, and Darwin's remark about the value of observing infants in order to ascertain how far particular movements and gestures are really expressions of certain states of mind,[4] is that he was probably dealing with two different sorts of phenomena. He was considering human feeling behavior on the one hand and animal instincts on the other, but Darwin is misled by

[1] What can be meant by 'insulting' a monkey? Darwin, 'Expressions of the Emotions,' p. 137.

[2] *Loc. cit.*, p. 10.

[3] One is strongly reminded here of Darwin's violent assumptions concerning the exalted æsthetic development in animals as described in connection with his theory of sexual selection.

[4] *Loc. cit.*, pp. 13, 122.

his conception of emotions and expressions to make the two identical.[1]

Among the many evidences which we might quote from the 'Expressions' to indicate this identification is Darwin's statement, that because the tender feelings are compound states and not simple feelings he could mention only weeping as their expression.[2] Also to the point here is the statement that blushing is the expression of many 'emotions' (shyness, shame, modesty) which are grouped under a single heading, namely, self-attention, no doubt, mainly as a heroic effort at correlation.[3] Do not these facts typify Darwin's inappreciation of the incongruity between critical observation of behavior and of forced injection of the continuity doctrine into the conventional and anecdotal tradition concerning emotions and their expressions?

If such be the case, is it not strange that current psychologists so readily accept the mentalistic continuity doctrine with its implication that emotions are persisting potencies which operate as properties of men and animals.[4] Here is evidence that about as much violence can be done to scientific facts by the uncritical acceptance of a continuity as of a discontinuity doctrine. A careful study of actual behavior discloses definite continuities in the activities of man and animals occasioned by similar organization and common external surroundings, but there are none the less just as definite discontinuities between the two types of organisms due to disparities of biological and psychological development and differences in surroundings. At the point of emotional behavior it is safe to say that observation discloses indefinitely more discontinuity than continuity.

In fairness we must add that Darwin did not entirely

[1] As Dewey (Psychol. Rev., 1894, 1, 555) so well expresses it, "In the discussion of movements in animals (pp. 42–48), the reference to emotions is not even nominal. It is a matter of 'satisfaction of desire' and 'relieving disagreeable sensations'—practical ends."

[2] *Loc. cit.*, p. 214.

[3] At the basis of the difficulties here is an implied acceptance of a structuralistic psychology.

[4] When not based upon observed facts such a doctrine would of course be a metaphysical proposition.

miss the difficulty of his views, for he says that love (maternal)[1] and practically all the complex feeling acts[2] have no characteristic expressions. But although this admission on Darwin's part implied a doubt as to whether the crude activities of animals and the refined behavior of human individuals are similar, his authority seems to be so incontestable as not to arouse comment when he implies that abstraction, denial, affirmation, and meditation are emotions, the expressions of which can be analyzed.[3] A slighter indication that Darwin suspected that all was not well with his formulation, to the effect that characteristic expressions exist for the emotions, is found in his report that when persons are confronted with photographs of expressions, they are not always able to attach the expressions to the emotions which they are supposed to express. For fear, however, that this would be too great a disturbing factor in his work, Darwin ascribed this inconstancy of the relation between the emotions and its expression to the misguidance of the imagination.[4]

Most incomprehensible it is that psychologists are not more sceptical of the doctrine that animals have emotions, if it is true that such a doctrine is based upon the sort of thinking we have been indicating. Surely there can be no question as to the vulnerability of Darwin's psychology. To indicate but a few weak spots we might ask how plausible it is that animals should voluntarily acquire emotional expressions. Further, what value can a theory have that fails to distinguish between thinking, and emotions and other types of feeling behavior. Again, we might ask whether such crude transmission of acquired behavior as Darwin supposes is consonant with observable facts. Hence, we might conclude that if the belief that animals have emotions is based upon the Darwinian foundation, it lacks much in scientific validity.

[1] *Loc. cit.*, p. 213.

[2] Called by him states of mind, *loc. cit.*, p. 261.

[3] From a subjectivistic standpoint, Darwin's performance is much mitigated, since after all what he is attempting to do in this book is to correlate the 'mental' and the 'physical.'

[4] *Ibid.*, p. 14.

But let us turn to the actual observations themselves, for we must not dismiss the problem without an attempt to examine some types of animal behavior which appear to have some resemblance to the emotional activity in human beings. Consider the action of the chipmunk stimulated by footsteps approaching from the rear, while he is calmly nibbling at some garden green. Immediately there is a start and shift of position while the animal turns to face squarely the approaching object; then scampers towards his hole or other place of safety. Now much as the activity just described may resemble an emotional situation, a careful examination of the details indicates no breakdown of stimulus-response coördination. The start observed is nothing but the ordinary change of attitude which we find in all attention responses. In fact this attention start, which superficially appears like an emotional phase of behavior, is always found present and in addition to the emotional phase in all actual emotional conduct; in sequence it precedes the emotion-initating perceptual or ideational process. Far from proving the presence of emotional behavior in animals, the attention-start points to the possibility of describing whatever activity we find in animals in their ordinary surroundings by referring to the practically full complement of congenital response systems with which they adapt themselves. Such acts as the attention-start the animal is uninterruptedly performing during each hour of its active life, and this fact would seem to indicate that these responses are due to a definite form of response system.

And now we may inquire into the findings of physiological research for light upon the problems of emotions. In particular, we might expect to gain some information from such experiments as are designed to test the Jamesian theory of emotions.

Unfortunately physiologists are parallelists and their work is seriously compromised by the assumption that in an emotional activity the organic changes are either the cause or the outcome of a psychic state called the emotion. Cannon[1] proposes to discover by the study of animals what

[1] 'Bodily Changes in Pain, Hunger, Fear and Rage,' 1915.

bodily results follow the functioning of the fundamental 'agencies which determine the actions of organisms.' And Sherrington[1] aimed to test the view 'that the psychical process of the emotion is secondary to a discharge of nervous impulses into the vascular and visceral organs of the body.' The unhappy feature of such work done on the parallelistic basis is the immediate setting aside of the so-called psychic factor and the confining of one's efforts to the exclusive investigation of the organic phases of behavior. In consequence, the essential differences in behavior are entirely overlooked and the assumption of a continuity in the behavior of man and animals results in endowing the latter with activities that are really found only in the former. In general, we might say that the physiologists have really been studying (1) visceral reflexes in pain, hunger, and fear-rage instinct behavior,[2] and (2) the relative functioning of the cephalic and more posterior portions of the organism in instinct action,[3] but not emotions.

Sherrington's conclusion from his experiments not only does not militate against the James-Lange-Sergi theory of the emotions, but on the contrary offers some evidence that he is not occupied with emotions at all. His discussion reads much like a tremendous overemphasis of psycho-cephalic parallelism and nothing more. The transection of cord and vagus cannot prove that emotions are cerebral processes, since the supposition that there exists an emotion in the form of a psychical adjunct has absolutely no basis in any observable fact. On the contrary, physiological experiments do appear to confirm the view that psychological behavior is the activity of the whole complex organism. Now the experiments seem to indicate that depending upon the intricacy of the behavior, the reaction systems may function when the organism is only partially coördinated. This fact is substantiated by Goltz's[4] decerebrate dog which 'showed' anger, but not fear, joy, and affection. May we

[1] *Proc. of the Royal Society*, London, 1900, p. 390.

[2] Cannon.

[3] Sherrington.

[4] Quoted by Sherrington.

not then assume that the animal behavior studied by Sherrington was really a series of instinct responses and not at all emotions similar to those found in the human species? The writer hastens to add that he accepts in its entirety the description of the behavior of the dogs which Sherrington has published, but reserves the right to reinterpret the terms joy, disgust, friendliness, so as to exclude completely the objectionable anthropomorphic implications. This reservation is necessary in view of the unfortunately extreme poverty of psychological language with which to describe animal reactions. Indeed, could Sherrington set aside his psychocephalic parallelism, he would be very sympathetic with our view concerning the absence of emotions in animals, since he writes that 'there is no wide interval between the reflex movement of the spinal dog whose foot attempts to scratch away an irritant applied to its back, and the reaction of the decerebrate dog that turns and growls and bites at the fingers holding his hind foot too roughly.'[1] Is it not true that in both cases we have the operation of truncated response mechanisms of precisely the same sort which Sherrington himself describes as pseudaffective reflexes?[2]

When we turn to the problem of emotions in infants we find a similar dearth of conditions capable of giving rise to emotional disturbances. Watson's studies of infants demonstrate the absence in the conduct histories of young children of the characteristic chaotic or no-response conditions, with the replacement of visceral and other reflexes. Watson does not agree with this view, however, and indeed believes he has found in infants three types of emotions, but our reading of his material convinces us that he has looked for and found only some specific instinct responses. The names he gives to these instinct responses, 'fear,' 'rage,' 'love,' seem to us to be arbitrarily applied and interchangeable.[3] In fact, when Watson's descriptions of the infant's responses are read to various persons, there is no general agreement as to the

[1] 'Integrative Action of the Nervous System,' p. 266.

[2] *Ibid.*, p. 251 ff.

[3] We are here reminded of Sir Charles Bell's assertion that animals 'seem chiefly capable of expressing rage and fear' (quoted by Darwin, *op. cit.*, p. 10).

appropriateness of the names he applies.[1] Although Watson[2] definitely asserts that an emotional act differs from an instinct by the occurrence of a momentary shock, his disregard of the differences between emotions and other feeling acts, not involving disruptive shocks, betrays him into making emotions into hereditary patterns of response. In this manner he obliterates the boundary between emotions and instincts, and moreover by invoking the criterion of non-training for hereditary acts he achieves the result that we have already described, namely, a discovery in infants of three kinds of emotions. The upshot of this procedure is that Watson veers considerably from the objective position and tends to interpret infant behavior, not from the standpoint of actually occurring responses to specific stimulating conditions, but as the manifestations of hereditary tendencies. What observer can overlook the differences between actual emotional behavior and comparatively simple positive responses which are offered to such stimuli as restraining, pulling a blanket away, striking, etc., responses which may just as well be called habits as emotions. We insist that while the failure of a stimulus-response coördination among older infants begins to be possible, because they have been acquiring responses to stimuli, yet it is true that as a matter of fact genuine emotional conduct will be an extremely rare occurrence.

XI

Emotions and Expressions.—As we have previously intimated some of the difficulties we encountered in the study of emotions in animals and infants are due to the still prevalent implication that in emotional reactions what we observe is an outward expression of a mental state called an emotion. Singularly enough, although Dewey[3] had long ago pointed out that expressions could have no meaning so far as the acting

[1] That is to say, when the persons who hear the description take the names to refer to emotional reactions. It is true, of course, that the names may be entirely appropriate for the reactions studied, but in that case we assume that the names symbolize a variety of behavior.

[2] 'Psychology,' p. 196.

[3] Psychol. Rev., 1894, 1, 555.

individual was concerned, the parallelistic conception of psychological behavior has to this day kept alive the inner-outer conception of emotions.

Illustrative of the influence which subjectivism exerts upon our minds is the fact that in the same papers[1] in which Dewey abjures emotional expressions, he employs himself in the defense of James' 'paradox' concerning the order of apparition of the invisible emotion and its visible physiological colligate. No doubt the reader recalls that the motive for this defense was Dewey's attempt to translate a philosophical conception into the biological terms which James's theory supplied. Dewey really meant to demonstrate that feelings are the internalizing of activity or will in the sense that an emotion is a report (feeling) in consciousness of an act previously performed.

But our purpose is not to revisit the scene of former battles; rather we wish to point out that when we stray from a description of actual behavior, the 'expressions' remain in our thinking, much disguise them as we may. Has Dewey avoided an unpsychological dualism by calling an emotion not an expressed entity, but a repercussion in consciousness of an organic happening? It is our opinion that Dewey has merely placed in relief a psychophysiological parallelism which at the point of emotions inspired James very little. For this reason Dewey could write[2] that "Prof. James himself does not seem to me to have adequately realized the inconsistency of Darwin's principles, as the latter states them, with his own theory." From that day to this the dualism has persisted through a multivaried modification of the expressions of the emotions to a serious neglect of the actual behavior of the person under the various conditions of emotional stimulation.

When emotions are studied as concrete behavior, we find absolutely no warrant for including in our description of them any dichotomy between the emotional acts and their expression. Moreover, there is no meaning in the question whether emotions precede or follow the expression. We

[1] PSYCHOL. REV., 1894, 1; 1895, 2.

[2] PSYCHOL. REV., 1894, 1, 554.

might just as well ask whether the perceptual action of another person precedes or follows our observation of it. It is obvious, therefore, that the emotion-expression dichotomy may be entirely rejected irrespective of the specific interpretation one makes of emotional behavior. We are inclined to believe that this dichotomy goes back in the final analysis to a non-naturalistic psychological hypothesis.

XII

Summary.—Unlike any other type of behavior the emotional reaction is not a positive response to a stimulus, but rather a failure of a stimulus-response coördination to operate. What happens is that the organism is left in a crucial situation (in the most striking cases) without certain expected or desirable means of adaptation, either because of not having a response system for the particular stimulating circumstances or because of some failure of such an acquired response system to operate. Emotions are therefore essentially 'no response' activities. The individual thus left without a directed mode of adjustment is thrown back upon primary responses, namely, organic reflexes. It is these replacement reflexes which give emotional conduct the appearance of positive adjustments. From this it follows that emotional conduct must not be interpreted as hereditary forms of adaptational activity, since emotions are either due to the break-down of an acquired stimulus-response situation or the absence of such a coördination which should have been developed to meet the needs of the present situation. The criterion for what reaction systems should have been developed depends upon the observation of those definite reactions the individual has actually acquired, namely, the precurrent perceptual responses. The latter, however, are not complete for the present situation without the consummatory reaction systems that are not operating at the time, but which apparently should have been acquired contemporaneously with the precurrent responses. Our criterion is of course based upon the apparent concrete needs of the individual at the moment, and is therefore frankly ephemeral, since the needs of the individual can only be determined by a field observation of the emotional reaction.

One of the significant results of the reactional interpretation of emotional conduct is that it forces to the front the distinction between emotions and feeling behavior. Fundamental in such a distinction is the fact that, unlike emotional conduct, feeling behavior of every type always involves the operation of definite response systems. A fact it is that almost every segment of behavior in which is found an emotional phase, will also include one or more feeling reactions, but in every instance the observer can adequately discriminate between the two types of conduct.

A natural consequence of the negative character of emotional behavior is that such action cannot be of general and necessary utility to the organism. In no sense can emotions be considered as determining adjustments of any kind whatsoever. Although it may sometimes occur that the disruptive dissociation of the emotional reaction may turn out to be a benefit to the person, yet such a consequence must be considered as a wholly fortuitous circumstance, and in general emotions must never be thought of as permanent directive agents which serve to carry the person through the intricate maze of daily events. On the contrary, emotional conduct is always truncated and ineffectual action, and can be useful only in elementary situations where the replacement reflexes can be of service.

Because emotions are negative or 'no response' actions, they cannot very readily be classified. Although the psychologist has trouble in grouping and correlating such behavior, this very fact is of extreme importance to the student of psychological phenomena, in that he is necessarily forced to study the emotional situation precisely as it occurs; and so the classification of emotional conduct must be based upon definite stimulus-response conditions, a fact making for exact and accurate, though extremely difficult, classification. Probably the most valuable result to be derived from such a work is the freeing of emotional conduct from their presumed dependence upon those teleological entities called instincts.

It follows from the dissociative and disruptive character of emotional behavior that emotions are seldom if ever found in animals and young children, since such organisms have not reached the stage of acquiring sufficient response systems to become disrupted. In animals and in infants the organic reflexes and other factors common to emotional reactions are parts of behavior segments which are positive responses to stmuli and are not replacement acts at all. An analysis of the behavior of animals and infants does not reveal conditions of a precurrent response failing to elicit its appropriate consummatory reaction, with the consequent replacement of this final act by organic reflexes as the only available mode of adjustment.

On the whole, it is hoped that such an organismic hypothesis as we have proposed will throw into clearer relief what has always appeared as an extremely baffling psychological phenomenon. Upon the basis of such a naturalistic standpoint emotions become familiar to us not as products of theory, but as vital modes of an organism's responses to disrupting conditions of its environment.

ON THE ORGANIZATION OF INTELLECT

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If we measure a group of men or children in respect to a random sampling of intellectual tasks, and score each on a scale running from low to high, or bad to good, using those terms in each case as psychologists or sensible persons in general would use them, we find two notable facts. All or nearly all the inter-correlations are positive. The inter-correlations range from low to very high values.

The first fact demonstrates that the net result of nature and nurture upon individual differences in intellect is not to compensate for weaknesses by strength, but to retain in respect to total intellect much of the variability found in any one segment or element or feature of it. The second fact directs us to search in the facts of inter-correlation for the principles according to which intellect is organized in nature originally and as a result of nurture's modifications.

As a result of his search, Spearman ('04) early announced the theory that one unitary factor is alone largely responsible for the positiveness of the correlations. The first statement of the theory was as follows ('04, p. 84): "All branches of intellectual activity have in common one fundamental function (or group of functions) whereas the remaining or specific elements of the activity seem in every case to be wholly different from that in all the others." This statement should be interpreted in the light of the following explanation (Hart and Spearman, 1912, p. 58 f.):—

"The opponents of the theory of a General Factor have taken this as claiming to be the *sole* source of correlation. Such an absurd claim does not seem really to have been advanced by any one. The earliest announcement of the principle was accompanied by a warning of 'its inevitable eventual corrections and limitations.' Special emphasis was laid on the fact that correlation between performances is also produced by great similarity between them. Obviously, as the similarity tends towards completeness, the correlation must tend towards unity. This fact was underlined by actual examples in numerical detail. For instance, the correlation between Latin translation and Latin grammar was shown to be far too large to fit into the theory, and this was attributed to the content being the same in both cases, namely, Latin. Another instance of the same sort was French prose and French dictation. A further one was furnished by the test of counting letters one at a time and that of counting them three at a time; here, there was a close similarity both of content and form, and accordingly this was pointed out as the cause of the principle becoming invalid.

"It was never asserted, then, that the General Factor prevails exclusively in the case of performances too alike: it was only said that *when this likeness is diminished* (*or when the resembling performances are pooled together*), *a point is soon reached where the correlations are still of considerable magnitude, but now indicate no common factor except the General one.* The latter, it was urged, produces the basal correlation, while the similarities merely superpose something more or less adventitious. Up to the present, however, these similarities seem to have exercised surprisingly small influence. In all the performances dealt with in the next section, only three times did any of them resemble each other closely enough to require pooling; these cases will be discussed in detail later on."

His most recent statement of it is:

"The purport of this theory is that the cognitive performances of any person depend upon: (*a*) a general factor entering more or less into them all; and (*b*) a specific factor not entering appreciably into any two, so long as these have a certain quite moderate degree of unlikeness to one another." (Spearman, '20.)

To the genius of Spearman we are indebted for a test or criterion of the truth of this theory in the form of the correlations of the correlations. If the theory is true, there will be an approximation to $r_{ap}/r_{aq} = r_{bp}/r_{bq}$, where a, b, p, and q indicate any of the tests in any set whence any that happened to be very obviously like others in the set have been eliminated; and in the corresponding table of correlations every column will have approximately a perfect correlation with every other column.

We have considered the correlations obtained from time to time in various studies at Teachers College from the point of view of Spearman's theory, and have in general not been able to corroborate it. The most extensive data at our disposal (McCall, '16) seemed decidedly adverse.[1] However, the facts in our material, as in that used by Spearman himself, were so complicated by the large probable errors of the intercorrelations themselves that it seemed best to search further.

What is desirable for the purpose is a table of intercorrelations—(1) for a fairly large number of traits, (2) from a very large number of individuals, (3) measured so accurately that the disturbing effect of corrections for attenuation is slight. I have at length found material which is very satisfactory in respect to (1) and (2). How well the third requirement is met I cannot say. Since Spearman authorizes the use of raw correlations, the matter is perhaps not so important as it seems to me.

It is the business of this paper to present the results of the application of Spearman's test or criterion to data from fifteen tests of 'intelligence' given to about 800 soldiers, and to seven tests of 'intelligence' and 'intelligence mixed with

[1] Spearman suggests ('20, p. 171) that in McCall's data "the intercolumnar correlation is always + 1.00, so long as the reservation is made, that the units of measurement should be chosen suitably. By this reservation, the positive sign can at once be restored throughout the intercolumnar correlations of both Webb and McCall." This seems to be an error; for changing the scoring so that, say, high scores on number checking are called minus and low scores plus, while it makes some of the intercolumnar correlations that were negative became positive, makes others which were positive become negative. No choice of the units of measurement that I can discover can make all the low negative intercolumnar correlations positive, unless it be one directed *ad hoc* and resulting in such absurdities as scoring a person as of less and less intelligence in adding the better he adds.

skill' given to over 900 soldiers. This material is perhaps better suited to the purpose than any that has hitherto been used.

I. The Case of the 15 Tests in the Army Alpha and Beta

The first facts are the intercorrelations of the eight tests of the Army Alpha and the seven tests used for the score in the Army Beta, as shown in Table I. For these I am indebted to Dr. Yerkes and the Division of Psychology of the Office of the Surgeon General.[1]

TABLE I

	Alpha								Beta						
	Directions	Arithmetical Problems	Common-sense Questions	Synonym Antonym	Disarranged Sentences	Number Completion	Analogies	Information	Maze	Cube	Rhythm	Symbol-digit Substitution	Number Comparison	Picture Completion	Geometrical Construction
	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7
ALPHA:															
1.....		.652	.468	.554	.573	.541	.713	.573	.421	.515	.509	.573	.482	.543	.328
2.....			.645	.651	.659	.645	.569	.663	.386	.520	.612	.600	.564	.520	.305
3.....				.669	.622	.490	.500	.595	.283	.353	.423	.573	.479	.440	.191
4.....					.691	.499	.436	.746	.299	.347	.408	.481	.396	.408	.159
5.....						.510	.539	.718	.316	.400	.443	.495	.458	.447	.264
6.....							.505	.554	.313	.459	.465	.461	.466	.395	.211
7.....								.546	.285	.270	.395	.457	.393	.336	.229
8.....									.301	.381	.491	.570	.499	.521	.252
BETA:															
1.....										.428	.451	.427	.342	.501	.292
2.....											.566	.494	.443	.509	.376
3.....												.625	.647	.125	.346
4.....													.670	.588	.336
5.....														.485	.327
6.....															.340
7.....															

These fifteen tests have the special interest for our purpose that all of Alpha were selected by psychologists to make a good team of tests of general intelligence. Consequently

[1] Any reader who is not familiar with the fifteen tests in question will find them described in Army Mental Tests, by Yerkes and Yoakum, pp. 53 to 90 and p. 205 ff.

these eight should, in as far as the psychologists did their work well, give due representation to the factors important in intelligence, and should not include any two tests that were unduly alike in any 'specific' factors and so would diminish the value of the team by overweighting those 'specific' factors.

Those of Beta were selected for the same purpose, with special attention to correlation with Stanford-Binet scores, but with, of course, the requirement of non-verbalness. We have, then, fifteen tests, all representing cognitive performances, all chosen with the aim of emphasizing general factors, and with no test in either set 'very obviously like any other' in that set to a much greater extent than any one is like any other in the set.

TABLE II

CORRELATIONS OF THE COLUMNS OF TABLE I

All entries represent thousandths.

	Directions	Arithmetical Problems	Common-sense Questions	Synonym Antonym	Disarranged Sentences	Number Completion	Analogies	Information	Maze	Cube	Rhythm	Symbol-digit Substitution	Number Comparison	Picture Completion	Geometrical Construction
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1 .		669	743	570	668	834	770	672	013	−131	132	294	355	098	−245
2 .			899	881	889	982	824	903	−101	039	241	575	532	064	−551
3 .				924	938	863	702	946	−203	−063	061	452	438	253	−647
4 .					736	734	836	941	−262	−037	212	479	412	312	−648
5 .						878	780	861	−357	−205	177	442	095	229	−422
6 .							819	824	−058	091	315	641	504	202	−289
7 .								741	−157	168	277	433	392	302	−356
8 .									−185	−055	078	410	366	112	−642
9 .										924	−129	488	679	015	984
10 .											189	533	692	−026	885
11 .												302	464	854	252
12 .													914	049	456
13 .														−029	393
14 .															129

The correlations of these columns of correlations were worked out following in every respect the requirements as to reliability and the allowances for disturbing effect that are specified by Spearman ('14). The results appear in

Table II in detail and in Table III for summary view. The correlations of the columns do not approximate + 1.00, but vary from − .65 to + .98 with a mean at + .35. The mean of any of the verbal tests with any of the non-verbals is near zero.

TABLE III

	Any One Alpha Test with Any Other Alpha Test	Any One Beta Test with Any Other Beta Test	Any Alpha Test with any Beta Test	Any Test with Any Test
−.90 to 1.00..				
−.80 to .90..				
−.70........				
−.60........			3	3
−.50........			1	1
−.40........			3	3
−.30........			3	3
−.20........			6	6
−.10........		1	4	5
− 0........		2	4	6
+ 0........		2	8	10
+.10........		2	4	6
+.20........		1	6	7
+.30........		2	5	7
+.40........		3	5	8
+.50........	1	1	3	5
+.60........	3	2	1	6
+.70........	7			7
+.80........	11	2		13
+.90........	6	3		9

II. THE CASE OF 7 TESTS OF INTELLECT AND SKILL

The data are the intercorrelations for an entire regiment of over 900 men, shown in Table IV. The group examination *A* is substantially the same as Alpha plus a test in memory of digits and a test in finding the largest and smallest in a column of ten numbers. The Ruger puzzles are a series of mechanical 'take-apart' puzzles of the general type described in the 'Psychology of Efficiency' (H. A. Ruger, '10). The other tests are described in Army Mental Tests (p. 105 ff.) For these data also I am indebted to the Division of Psychology of the Office of the Surgeon General.

These tests would probably be classed as tests of cognitive performance. The Stenquist test in assembling a simple wrench, chain, bell, lock, etc., is called a test of skill and does involve manual dexterity as well as mechanical insight. The Ruger puzzles involve some persistence and skill in manipulation, but if psychologists had to choose between classifying them as cognitive performance and as motor performance, they would choose the former. The others are stock tests of intelligence.

TABLE IV

CORRELATIONS OF THE INDIVIDUAL SCORES, ADULT SOLDIERS; AN ENTIRE REGIMENT, $n > 900$

	Group Exam. *A*	Stenquist Skill	Porteus Mazes	Ruger Puzzles	Pyle Digit-symbol	Terman Designs	Cube Construction
Group Exam. *A*		.475	.456	.371	.782	.538	.158
Stenquist skill	.475		.485	.427	.530	.495	.509
Porteus mazes	.456	.485		.296	.529	.496	.396
Ruger puzzles	.371	.427	.296		.237	.297	.264
Pyle digit-symbol	.782	.530	.529	.237		.600	.475
Terman designs	.538	.495	.496	.297	.600		.439
Cube construction	.158	.509	.396	.264	.475	.439	

The correlations of the columns were computed according to the specifications of Spearman, with the results shown in Table V. They range from 1.00 (for Stenquist assembling test with Porteus mazes, Stenquist with Terman designs, and Porteus with Terman) to negative values (for Ruger puzzles with all the others save the Pyle digit-symbol test). The mean (counting the extreme negative case as − 1.00) is .46. If we leave out the Stenquist and Ruger test, retaining only the stock tests of intelligence, the correlations range from 1.004 to .332 with a mean of .68. There

TABLE V

CORRELATIONS OF THE CORRELATIONS OF TABLE IV, BY COLUMNS, CORRECTED AS SPECIFIED BY SPEARMAN ['14]

	1	2	3	4	5	6	7
	Group Exam. *A*	Stenquist Skill	Porteus Mazes	Ruger Puzzles	Pyle Digit Symbol	Terman Designs	Cube Construction
1		.450	.712	− .157	.365	.685	.625
2			.996	−2.560[1]	.880	.996	.846
3				− .121	.831	1.004	.585
4					.392	− .263	−.226
5						.954	.722
6							.332

[1] The uncorrected value is −.917.

is here again no approximation to 1.00—no support for the theory.

III. The Case of 9 Tests of Intellect

The Spearman correction by

$$R_{ab}' = \frac{S(\rho_{xa}\rho_{xb}) - (n-1)\overline{r_{ab}\sigma_{xa}\sigma_{xb}}}{\sqrt{S(\rho_{xa}^2) - (n-1)\overline{\sigma_{xa}^2}}\ \sqrt{S\rho_{xb}^2 - (n-1)\overline{\sigma_{xb}^2}}}$$

is laborious and has been attacked as unfair by Thomson ('19). Where the number of cases is large it may be fairly satisfactory to omit it. This shorter procedure I have used

Table VI

Intercorrelations of Beta Tests
(653 English Speaking Cases)

	Maze	Cube	Rhythm or XO Series	Substitution	Number Comparison	Picture Completion	Geometrical Construction	Spot Pattern	Stanford Binet
	1	2	3	4	5	6	7	8	
1...		.477	.522	.514	.457	.490	.510	.476	.465
2...	.477		.632	.576	.560	.556	.592	.551	.545
3...	.522	.632		.689	.670	.584	.597	.619	.614
4...	.514	.576	.689		.766	.654	.584	.695	.639
5...	.457	.560	.670	.766		.619	.521	.703	.622
6...	.490	.556	.584	.654	.619		.555	.569	.586
7...	.510	.592	.597	.584	.521	.555		.559	.610
8...	.476	.551	.619	.695	.703	.569	.559		.572

Table VII

Correlation of the Correlations of Table VI. N = 653. Uncorrected. For Beta Tests and Binet

	1	2	3	4	5	6	7	8	Binet
1. Maze		.88	−.03	−.51	.15	.09	.73	.03	.37
2. Cube			.56	.27	.27	.39	.88	.32	.73
3. Rhythm or XO Series Completion				.62	.73	.95	.56	.73	.70
4. Substitution					.95	.90	.15	1.00	.77
5. Number Comparison						.95	.39	.95	.66
6. Picture Completion							.27	.90	.90
7. Geometrical Construction								.15	.26
8. Spot Pattern									.94
9. Stanford Binet									

with the correlations for 653 individuals tested with the Stanford revision of the Binet tests, and with the seven Beta tests noted above, and also with test 8 of the Beta (a 'Spot Pattern' memory test). For this material also I am indebted to the Division of Psychology in the office of the Surgeon General. The data appear in Table VI. the correlations of the correlations are shown in Table VII. The mean is .54 for all; for tests 1 to 7 it is .48.

General Considerations

The results above are obviously in better agreement with the views of Thomson ('16, '19*a*, '19*b*, and '19*c*), the qualified statements of Spearman in the 1912 paper with Hart, and the statements of the author ('14, p. 370 f.) than with a rigid, unqualified form of Spearman's doctrine. They are indeed adverse to the theory that the cognitive performances of an individual depend upon one general factor found in all, plus a specific factor not entering appreciably into any two, so long as these are moderately unlike. We cannot describe an ability by stating the proportion of it which is constituted by the general factor, and describing the specific factor which constitutes the balance. Checking pairs of numbers as like or unlike is not $XG + YN$, where G means general intelligence and N something found only in checking pairs of numbers or other abilities very closely like it. We may indeed find factors common to all cognitive performances but not in parallel amounts, factors common to many, factors common to few, factors specific to one.

We must, it appears, turn back with open mind to the details of intercorrelations and experimental analyses to work out the organization of intellect. Especially needed seem studies of the 'partial' inter-correlations with one after another of the factors equalized. For example, what are the variations and interrelations in various cognitive performances within a group all of identical status in understanding the vernacular language? The correlations of the columns also need not only to be tabulated to see their distribution, but also to be inspected in detail to see concretely and in particular what abilities a, b, c, etc., behave like others in their correlations with still others α, β, γ, etc.

For surety and convenience in this last enterprise we need, of course, original measures of high reliability, with large numbers of individuals, each measured in many traits, such as require heroic industry to obtain. The principle may, however, be briefly illustrated here from the Army data already used. For example, consider this question, "Which tests in Alpha behave most like which tests in Beta in respect to their intercorrelations?"[1] Of the fifty-six likenesses, the four most like are, in order:

Number completion with Symbol digit substitution,
Arithmetical problems with Symbol digit substitution,
Arithmetical problems with Number comparison,
Number completion with Number comparison

(corrected correlations of the columns, 641, .575, .532, .504). The four least like are, in order of unlikeness:

Opposites with Geometrical construction,
Common-sense questions with Geometrical construction,
Information questions with Geometrical construction, and
Arithmetical problems with Geometrical construction

(corrected correlations of the columns, − .648, − .647, − .642 and − .557).

If we now ask which tests the aberrant geometrical construction is like in its inter-correlations, we find .984 as the column correlation for it with the maze test, and .885 as the column correlation for it with the cube construction test. The next most like is only .456, the Symbol digit substitution test.

These cases are, as said, illustrative rather than evidential, but they obviously suggest that a 'numbers as content' factor and a 'spatial relations as content' factor act in a fashion midway between nearly complete generality and nearly absolute specificness. I believe that suggestions of factors referring to the 'form' of cognitive performances

[1] The number of individuals is here over 800, and the number of tests with which intercorrelations are computed is 15; the unreliability of the original measures is unknown, so that the examples should be taken as illustrative rather than demonstrative comparisons.

such as 'to keep in mind for a long time' or 'to utilize a large amount of content together for one purpose,' or 'to break up a gross total content into elements' will appear in a similar way in the correlations, partial correlations, and correlations of the correlations of cognitive performances.

All the above, of course, concerns individuals as we find them, products of nature and nurture. Spearman's doctrine might fit the *original* nature of intellect better. Certain factors, like ability to understand oral language, ability to read, ability to perceive objects in three dimensions, which occur to anybody as neither entering into all the cognitive performances of a person nor entering into only a few very closely similar performances, might in original nature be absorbed into one unitary ability to learn. Everybody will agree that many of the complexities of individual differences are superadded by likenesses and differences in training. I fear, however, that even if we did dissect out all the consequences of nurture, leaving only a skeleton of inborn capacities, the organization of these would still be much more complex than that required by Spearman's theory.

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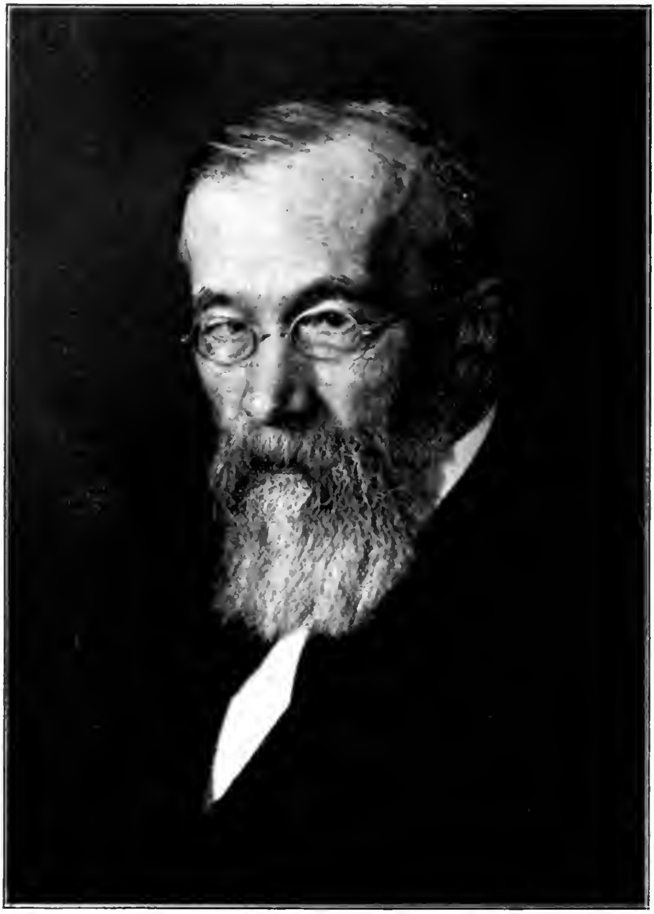

W. Wundt.

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153.

The Psychological Review

IN MEMORY OF WILHELM WUNDT

BY HIS AMERICAN STUDENTS

At a meeting of the University of Iowa Philosophical Club held October 19, 1920, a symposium on the philosophical and psychological contributions of Professor Wundt furnished the program. Reports on Wundt's philosophical and ethical studies were given by Professor G. T. W. Patrick, a former student, and Professor Edwin Starbuck. Dean C. E. Seashore, who also knew Wundt personally, discussed his psychology, Dr. Lorle I. Stecher outlined his publications, and the writer, who is president of the club, supplemented his own reminiscences of the psychology work at Leipzig in 1906 with a series of letters from a number of Wundt's distinguished students in psychology.

At the annual meeting of the American Psychological Association in Chicago, December 1920, a commemorative exercise in honor of Wilhelm Wundt followed the president's address on the evening of the 29th. Reminiscences of Wundt were given by Professors J. McK. Cattell, C. H. Judd, W. D. Scott, and R. Pintner.

The following papers include the letters read at the Iowa meeting, together with the more extended contributions of Cattell and Judd read at Chicago, and reminiscences from other students of Wundt furnished at the suggestion of the Psychological Review. It seems appropriate to publish these tributes by Wundt's American students in a collected form at this time.

A great teacher is known best by the type of trained students who leave his laboratories and carry further his principles to finer determinations and more subtle and more useful applications. No teacher in psychology has had more distinguished students from many countries than Professor Wundt; and in America, where experimental psychology has made greatest advances during the last three decades, many of the great leaders were students at Leipzig for short or long periods during Wundt's creative directorship.

The first two young men to work at Leipzig and later to found psychological laboratories in this country were President G. Stanley Hall and Professor J. McK. Cattell, the former being a student in 1879–80 and the latter in 1880–82 and 1883–86. Dr. Hall founded the laboratory at Johns Hopkins in 1883 and Professor Cattell the laboratory at Pennsylvania in 1887. Many of Wundt's other American students either founded laboratories on their return from Germany or played a leading part in the development of the experimental laboratories in America.

The following contributions are arranged chronologically according to the date at which the writers were connected with the Leipzig laboratory. The key-note of the symposium is Wundt's personality. No attempt is made to appraise the value of his scientific work; that remains for the future to determine. In the foreground we see Wilhelm Wundt, the man and the teacher, reverenced by his pupils and inspiring them with zeal for exact and honest scientific research.

B. T. B.

I

I think I was the first American student to work in Wundt's laboratory. It was in its early days—I think about 1878 or 1879—and I only served as subject, for I gave all my time during the two years I was there to work in Physiology with Ludwig. There was then an impression that Wundt was not very scientific, and there were rumors that Helmholtz had found him too inexact as his assistant. One group, I remember, thought Horwicz should have been elected to Wundt's chair. Wundt was very rarely seen in his laboratory, and impressed me as rather inept in the use of his hands. Most of his time was spent in preparing his amazingly clear and popular lectures, which were always crowded. I attended his seminary, the method of which in my time was to have every member read and carefully epitomize books, articles, etc., assigned by Wundt, he himself, as I remember, taking notes incessantly. I felt that our business as members of the seminary was chiefly to read for him, and I think this contributed much to the impression of the great erudition which characterizes his works.

Save his doctrine of apperception, it does not seem to me that he made any epoch-making contributions to psychology although he will always fill a large place as the first to establish this science on an experimental basis. He was a wonderful compiler and digester, and I have always felt that his *Völkerpsychologie* was really quite as important and involved quite as much commendable labor on his part as did the *Physiologische Psychologie.*

He was a very able and effective controversialist, but it always seemed to me that he was short-sighted and partisan in antagonizing the new introspective movement started by his own pupils, as Freud has been in antagonizing Adler and the Zurich school. Both tried to devour their own children. This antagonism seemed to me an illustration in the scholastic field of the spirit of the old German feudal overlord.

I have always felt, too, that if Wundt had been half as much of a biologist as he was a physiologist he would have given our science a broader basis, and also that he was too prone to ignore the contributions of psychiatry.

Nevertheless, he did a remarkable and epoch-making work, and I for one feel no less debt of gratitude to him as a psychologist even though he bitterly denounced the Allies in a narrow and almost bigoted way and was one of the ninety-odd signers of the notorious Manifesto.

G. Stanley Hall

II

Forty years ago I studied in Göttingen and in Leipzig, hearing the lectures given by Lotze and by Wundt. It seems odd, as I look back on it, that I made no effort to become acquainted with either of these great men. They seemed elevated far above the twenty-year-old student, who at their lectures wrote 'als dictirt euch der Heilig Geist.'

My first personal meeting with Wilhelm Wundt was in his conversation room in the autumn of 1883. A notice had been posted appointing a conference with those who wished to join his seminar for research, and there appeared six or seven of us, representing almost as many nationalities. Stanley Hall had been there a year or two before, but worked mainly with Ludwig and served only as Versuchstier in the newly established laboratory of psychology. We were followed by other Americans in large numbers; eighteen of the fifty psychologists selected in my study of 1905 had worked at Leipzig and there were many more; now our students and our students' students, even to the third and fourth generations, trace their descent from the Leipzig laboratory.

In one of his recently published letters, William James wrote to Karl Stumpf of Wundt: "Was there ever since Christian Wolff's time such a model of the German professor?" This more formal and official side was shown in our first conference, for he had in his hand a memorandum containing a list of subjects for research and taking us in the order in which we stood—there was no question of our being seated—assigned the topics and hours to us by a one-to-one correspondence. As a large part of the work of the laboratory was then on reaction-time experiments, it is not surprising that such a subject fell to my lot, and it was fortunate, for I had already in America begun experimental work on the time of sensori-motor processes. Wundt, however, was mainly interested in experiment for the aid it gave to introspection, and the subject assigned to me was to react as soon as I saw a light and in a second series to react as soon as I recognized its color, with a view to analyzing the factors of apperception. This I could not do, and in my second interview with Wundt I presented an outline of the work I wanted to undertake, which was the objective measurement of the time of reactions with special reference to individual differences. Wundt said that it was "ganz Amerikanisch"; that only psychologists could be the subjects in psychological experiments. I later bought and made the apparatus needed and did the work in my own room, without, however, any interruption in relations that were then becoming friendly.

My last interview as a student with Wundt was at my doctorate examination when the sympathy and kindness that great men usually have, but are often too shy to show, were much in evidence. In accordance with the pernicious method copied into our universities, the candidate was examined in three subjects, psychology being then only a part of philosophy. I had some knowledge of mathematics, physics, physiology and zoölogy as related to my own work, but not much besides. I began to attend Klein's lectures on mathematics, but found them hopeless. Finally I selected physics and zoölogy, and Wundt was most anxious that I should get through. He explained that Hankel was mainly interested in the refraction of light by crystals, and Leuckhart in parasites, and that I should read their papers on these subjects and lead up to them if I could. In the examination before the faculty, Wundt asked me things that I was sure to know and then to make it plausible a couple of questions that no one but a German professor of philosophy could possibly know. During the rest of the examination he was even more nervous than the candidate.

Personal reminiscences are wanted, so I may relate two or three incidents that are more or less characteristic. Wundt was asked for an introduction to Stumpf, next to him the leading German psychologist, then at Halle only twenty miles from Leipzig. He said that he was sorry that he could not give it; he was not personally acquainted with Stumpf; it was better so, for there might be scientific subjects on which they would differ and then each could speak more freely. This did happen later, and each did tell the truth as he saw it without violating the courtesy that personal acquaintance might from their point of view have required. In like manner with characteristic kindness, perhaps to me as well as to her, he admitted an unusually intelligent American girl to his lectures on psychology at a time when this was a rare privilege in a German university. There were two or three hundred German students in attendance, probably the most stupid ones in the university, for they were mostly theologues, for whom the course was compulsory.

Wundt a little later said: "I am sorry that I admitted Miss X to the lectures; it quite troubles me; I feel always that I ought to speak in a way that a woman can understand." This I submit, while reminiscent of the Kaiser's three K's, betrayed true knightliness in the old style.

In one respect Wundt was modern and American. He had injured his eyesight by experiments on vision and was much interested in a typewriter that I took with me to Germany when such a thing was almost unknown there. So I got one for him, and thereafter he did all his composition on it. I am told that Avenarius said it was an evil gift, for with it Wundt wrote twice as many books as would otherwise have been possible. Apart from the typewriter, Wundt lived remote from the rough ways of democracy. The idea of visiting the United States, when I urged it, or even of going to England, rather frightened him. But, while there was a certain narrowness in the life of the German university professor of fifty years ago, the provincialism was that of a true intellectual and social aristocracy. With them the family life is nearly always simple and fine; it was surely so in the apartment at Leipzig, to which it was my privilege to be admitted, formally at first, and then more intimately, as on leisurely walks on Sunday afternoons and at Christmas Eve ceremonies, when only Mrs. Wundt, a woman of rare charm, and the two little children were there.

Wundt was somewhat disturbed that I became acquainted at Leipzig with Wilhelm Liebknecht, the leader of German socialism, but with characteristic consideration he wrote to me some years later that I should be interested to hear that in the gymnasium his son Max and Liebknecht's son Karl were inseparable friends. Max Wundt has become professor of classical archeology; Karl Liebknecht, almost alone in the Reichstag, opposed war in 1914, as his father did in 1870; then at the hour of mingled defeat and victory he laid his life on the altar of the God whom he served.

Wilhelm Wundt too is dead. The London *Times* and other journals have impertinently remarked that he would have been more honored if he had died before signing the manifesto of the ninety-three German professors—that rather absurd, but truly pathetic and noble appeal to the good-will of the world. The civilization for which those men stood ranks in its fine distinction with the best periods of Greece, Italy, France and England. It is now submerged in blood and ashes, sunk under the weight of its virtues and its sins, of the specious idealism and crude materialism of its overlords, its allies and its enemies. Let us hope that the brute arbitrament of force may once more yield to the generous rivalry of science and of diverse civilizations, and not hope only, but do our part to repay the debt that we owe to the dead.

These remarks are by order limited to personal reminiscences and to ten minutes. Wundt's leadership in laying the foundations of psychology, his vast contributions to nearly the whole range of the philosophical disciplines, are not here under consideration. The fact that his work for psychology was begun sixty years ago proclaims its fundamental character and accounts for its limitations. We advance over the temporary bridges built by men such as he, and they are more nearly works of genius than are the rubble and cement with which we may later replace them. Wundt was before all a scholar, absorbed in his scholarship; with that complete detachment from the here and now and the narrower self that often characterizes the hereditary noble and the true scholar.

> This is our master, famous, calm and dead. . . .
> Leave him—still loftier than the world suspects,
> Living and dying.

J. McKeen Cattell

III

It was in the autumn of 1889, that I entered the University of Leipzig and became acquainted with Professor Wundt. My knowledge of German was meagre; and I had serious misgivings as to my first interview with the Herr Geheimrath. He reassured me at once, however, by saying that though he spoke no English, he understood it and would be glad to have me use my own language.

On learning that I had been a student in Rome, he remarked: "Why then, you are familiar with the philosophy of St. Thomas"; and in the course of the conversation he showed that he was thoroughly informed in regard to the neo-Scholastic movement inaugurated by Pope Leo XIII.

At this meeting also, noticing that I had a copy of the Verzeichniss der Vorlesungen, he suggested that the list of courses was attractive and that, like other students, I would probably be tempted to register for a large number of subjects. "Do not attempt too much," he said; "this is the best advice I can give you."

Wundt impressed me as a man who sought earnestly for the truth. With a wide range of knowledge he combined an accuracy, even a severity, of thought, the result of his scientific training. While he adopted the latest methods of research and in one field at least did the work of a pioneer, he appreciated the achievements of the past and gave full credit to his contemporaries who so often took a different point of view.

His lecture hall, with sittings for some three hundred students, was always well filled. It was a cosmopolitan audience which reminded me, in some respects, of the Urban College in Rome. Punctuality was one of the professor's virtues and it had the desired effect upon his auditors. Whatever the subject—and he covered the whole ground of the philosophical and psychological sciences—his hearers were sure of an interesting lecture. It was delivered with earnestness and fluency. Wundt always laid upon the rostrum a notebook; and then forgot that it was there. Some of the students knew that his vision was defective; and for that reason they formed a higher estimate of the man's energy and erudition.

The psychological laboratory, in that day, was primitive enough. It occupied a half dozen rooms in the old building which has since disappeared. There was no great show of apparatus; but such as it was, it was nearly all in daily use. Additions to it were, for the most part, of Wundt's own devising. Of the men who worked there, at least two-thirds were Americans. Some have become leaders in psychology and have made known the principles and methods of the Leipzig school to students in various universities of our country.

Usually, the Professor met the research students in the laboratory after his lecture. Those were moments of free-and-easy intercourse. They gave an opportunity to get advice concerning problems under investigation, to discuss new publications or to secure an expression regarding the statements which came from various quarters with reference to the findings of the Leipzig laboratory.

For the acrimonious, Wundt had little use. He could take part in a discussion quite vigorously; but he preferred to conduct it on a high level. If, in his lectures, he adverted to those who differed from him, there was no trace of narrowness in his criticism. On the contrary, I recall that he deprecated the temper of an ardent writer who, in coming to the defense of the Leipzig Institute, had been rather severe upon the author of the attack.

There was a certain intensity about Professor Wundt, due no doubt to the fact that he saw continually wider and wider horizons opening before him. It seemed at one time as though his absorption in speculative problems had drawn him too far from scientific interests. Probably he thought that the 'System der Philosophie' was the necessary culmination of his scientific labors. In point of fact, his enthusiasm for psychology had not cooled, as is evident from his later publications.

Wundt's habits were of the simpler sort. There was no ostentation about him. I think that he was gratified to have students from all parts of the world coming to his lectures, and still more to see his disciples filling chairs both in Germany and beyond its borders. But his success did not make him less approachable. He went on his accustomed way, patient and laborious, and always ready to help others out of the fulness of his own knowledge.

To see him, half an hour before his lecture, passing along the Promenade, no one would have suspected that he was among the foremost thinkers of his day. Few, even of the students, recognized him. He was not followed by a 'Shadow of Providence'; and yet, as he went along, one thought, quite naturally, of a street in Königsberg.

EDW. A. PACE

IV

The paragraphs printed below are from a letter written in 1890 immediately after my first hearing of a lecture by Wundt. The impression of triangularity to which I refer is excellently brought out in the portrait by Dora Arnd-Raschid (published by the Berlin *Photographische Gesellschaft*); it is less obvious in the Perscheid photograph of 1904.

"The *famulus* swung the door open, and Wundt came in. All in black, of course, from boots to necktie; a spare, narrow-shouldered figure, stooping a little from the hips; he gave the impression of height, though I doubt if in fact he stands more than 5 ft. 9.

"He clattered—there is no other word for it—up the side-aisle and up the steps of the platform: slam bang, slam bang, as if his soles were made of wood. There was something positively undignified to me about this stamping clatter, but nobody seemed to notice it.

"He came to the platform, and I could get a good view of him. Hair iron-grey, and a fair amount of it, except on the top of the head,—which was carefully covered by long wisps drawn up from the side. Forehead not high, but very broad and swelling at the temples. Eyes dark behind rather small-glassed spectacles, very good: honest, friendly, alert; but there is something sadly wrong with the muscles of the right. Nose, as the passports say, ordinary; depressed at the bridge, but rising below to a serviceably sized organ. Mouth covered by a heavy drooping moustache, and chin by a shortish square-cut beard, iron-grey like the hair. The general impression, in spite of the bluntish beard, was of an inverted triangle: the head must be tremendously broad at the temples, for there is no hint of any weak pointing of the chin.

"The platform has a long desk, I suppose for demonstrations, and on that an adjustable book-rest. Wundt made a couple of mannered movements,—snatched his forefinger across his forehead, arranged his chalk,—and then faced his audience with both elbows set on this rest. A curious attitude, which favours the impression of height. He began his lecture in a high-pitched, weak, almost apologetic voice; but after a sentence or two, during which the room settled down to silence, his full lecturing voice came out, and was maintained to the end of the hour. It is an easy and abundant bass, somewhat toneless, at times a little barking; but it carries well, and there is a certain persuasiveness, a sort of fervour, in the delivery that holds your interest and prevents any feeling of monotony. A good sort of voice, I should think, for a lecturer whom one has to listen to month in and month out. The lecture was given without reference to notes; Wundt, so far as I could tell, never looked down once at the book-rest, though he had some little shuffle of papers there between his elbows.

"I told you that the attitude struck me as curious. So was the play of hands and forearms all through the lecture. Wundt did not keep his arms lying on the rest: the elbows were fixed, but the arms and hands were perpetually coming up, pointing and waving. You might think that this movement would be embarrassing, even distressing, to watch; but it wasn't; I had the fanciful impression that Wundt was using his hands where the ordinary lecturer turns his head and eyes; the movements were subdued, and seemed in some mysterious way to be illustrative. Very characteristic, anyhow, the rigid body and the almost as rigid head, and these hands playing back and forth between the voice and the audience.

"He stopped punctually at the stroke of the clock, and clattered out, stooping a little, as he had clattered in. If it wasn't for this absurd clatter I should have nothing but admiration for the whole proceeding."

E. B. Titchener

V

I had come back to Leipzig in the fall of '91 and got my first glimpse of Wundt as he was going up the stairs to his lecture room in the new university building. And the sight was anything but reassuring to one who had been moved to return to his 'alma norverca' through a feeling of academic piety focussed mainly around the person of the "chief".

Wundt was toiling feebly and slowly up the ascent, to all appearance hardly able to cope with the weight of a huge overcoat which hung loosely around him, and it was with the misgiving that I was destined to hear merely fragments of a lecture delivered by a broken old man that I entered the lecture room.

But all misgivings vanished when I 'apperceived' the hall: it was the largest lecture-room in the university and crowded to the limit of its capacity. During the lecture my neighbor volunteered the information that there was no lecture-room in the university large enough to hold the audience that 'subscribed' to the lectures on psychology. Assuredly the setting betokened no lack of power in the lectures and assuredly there was no trace of senility in the lecturer. It was the old Wundt of 1890—the clear enunciation, the well-rounded sentences, the dignified utterance, the occasional gesture with the loosely clenched hand—hardly a fist—the respectful reference to his charts—it only needed the bi-syllabic pronunciation of 'Jon' Locke's surname to make one feel that no change had taken place in the Wundt of a former decade.

I cannot say that the social side of one's intercourse with Wundt, as expressed in the bounteous dinners which he gave from time to time to the 'Fortgeschrittene' and laboratory assistants, very much furthered a 'man to man' acquaintance-ship between teacher and students, and this perhaps less through Wundt's attitude than through that of the German contingent among the guests. For their attitude seemed to be that of men questioning an oracle, and when the oracle answer came, questioning or discussion ceased. It must be said also that in this situation the oracle was rarely dumb or ambiguous. Nevertheless when some untamed transatlantic neophyte blurted out an objection to an oracular response or applied some hardy paradox to it, I had the impression that Wundt actually welcomed what the pious considered an interruption—manifesting the welcomeness by a smile which had in it nothing superior or condescending.

To the much bandied reproach of Wundt's intolerance of views that did not agree with his own, my three years' experience in the Leipzig Institute gives not the slightest support, though this does not say that it was easy to convince him of defects in some course of laboratory practice fathered by him but which, in the ordeal of a new investigation, had been found wanting. In my "Arbeit" I had run counter to some of the Wundtian doctrines and in particular had girded against his law of relativity as explanatory of Weber's Law. To this he made no demurrer nor discussed the point, but simply asked me what was my main objection to the 'Gesetz der Relativität' and then passed on to a new topic. Parenthetically it may be said that when I started in to discuss my Arbeit with Wundt I felt that I knew more about the limited domain which I had been exploring than anyone, including Wundt—a state of mind probably not infrequent with burgeoning doctors—but before the interview was over I felt that Wundt knew more about the subject both in itself and in its relations than was either right or proper for any one person to know. The interview was of the nature of a revelation to me.

The popular belief that a great philosophic mind is more at home when dealing with abstractions than with ideas of concrete objects finds documentary support from one of the tables in an early edition of the 'Physiologische Psychologie', where one may see that while it took Wundt appreciably longer to react logically to words denoting concrete objects than was the case with his co-workers, when it came to reactions to far-reaching abstractions his record was almost absurdly short.

But Wundt's immersion in the depths of philosophic thought had not washed out of him a capacity either for warm emotions or for deep emotions. Misuse of laboratory apparatus was sure to arouse in him indignation which was not slow to find vent in winged words, and I have seen him white and trembling with anger when some of his 'Zuhörer,' bent on hearing a Wagnerian overture, slipped out of a lecture on philosophy shortly before its close.

But a far deeper and more complex emotion than anger overcame him when the 'Festschrift' closing the series of the *Philosophische Studien* was presented to him on his seventieth birthday.

We had journeyed up to the little village in the Thuringian Forest where Wundt, as was his wont, was passing a part of the summer holidays—Külpe, Kraepelin, Meumann, Lange, Kirschmann—I do not recall the names of all—and when Wundt was brought in before this little gathering of men who had been his laboratory assistants, some of whom he had not seen for a decade and some not since the earliest days of the *Studien*, he broke down completely and for some minutes the ready speaker and accomplished orator was unable to utter a word. And when the 'Festschrift' was handed to him by Külpe who spoke with great sweetness and with reverential dignity, again the old man was hardly able to speak.

That was the last time I saw Wundt and I felt then as I felt in my student days that I had come into the presence of a great man. For depth and range of learning, for capacity for generalization, for power of scientific imagination, he was the ablest man I ever met.

FRANK ANGELL

VI

The foremost service of Wilhelm Wundt to psychology was the foundation of laboratory investigation. Before his time experimental research in psychology had been mainly individual. Weber and Fechner had experimented privately —apart from their university work. Wundt secured the recognition of his laboratory as a university institution, with rooms in one of the university buildings. He gathered around him an enthusiastic group of students and assistants, whom he trained in the methods of exact experimentation, and he selected their research problems in such a way as to cover every part of the field.

The tremendous interest in experimental psychology which suddenly developed—the spread of research in Europe and America during the '90's—is due in large part to the example of the Leipzig laboratory and the efforts of Wundt's pupils.

As soon as the Leipzig laboratory was fairly launched, in 1883, Wundt started a magazine, the *Philosophische Studien*, which was devoted to the publication of research papers. The earlier volumes contain many notable articles by men whose names have since become well known in the psychological world. Cattell, founder of the laboratories at Pennsylvania and Columbia; Scripture, who started the laboratory at Yale, were among Wundt's earlier pupils. Stanley Hall, who opened laboratories at Hopkins and Clark, was an observer of Wundt's work during his stay at Leipzig. These men belong to the '80's. In the early '90's Frank Angell, Pace, Titchener, and Witmer were my fellow-students there. These, and others who have since fallen by the wayside, are responsible for the scores of laboratories which suddenly sprang into being in America and soon outstripped the German laboratories in productivity.

At the period I speak of there were students from Russia, Norway, and Rumania working under Wundt, who spread the movement in their own countries. Of the Germans, Kiesow was called to Italy, Meumann to Switzerland, Kirschmann to Canada. Külpe and others carried the spirit of Wundt's laboratory to other German universities. I speak only of my own time. The same influence continued till the outbreak of the war.

I would not in the least undervalue the personal contributions of other German investigators—of men like G. E. Müller, Ebbinghaus, Münsterberg, and Stumpf. As individuals these perhaps obtained more important original results. But Wundt, working through his pupils and directing their lines of research, far outstripped them all. An examination of his 'Grundzüge,' that great compendium of psychological results, is sufficient to prove this.

Apart from specific additions to our psychological knowledge, the Leipzig laboratory was largely instrumental in embuing psychological investigators with the spirit of *exactness* and *thoroughness* in research. And it was responsible for many of the standard pieces of apparatus with which our laboratories are equipped. All these are part of the same general development—the research laboratory for human psychology. Wundt's first claim to the homage of psychologists is that he is the father of laboratory psychology.

The value of Wundt's contributions to psychological principles may be challenged. Some of his most notable theories have already been discarded. His doctrines of innervation feelings, of apperception, of chromatic and achromatic vision, of tonal relations have been superseded. But his conception of psychological experimentation prevails today as strongly as ever, and seems likely to govern future work for many years to come.

Speaking of Wundt as a man, what impressed me most was his vast, encyclopedic knowledge. His lectures covered the entire field of psychology and philosophy. Animal psychology and folk psychology were among the courses which he offered, as well as logic, ethics, and history of philosophy. His 'Völkerpsychologie' contains a wealth of material; one marvels at his being able to carry this work through to completion at the age of 70.

One of my pleasantest memories of Leipzig days is a lecture on English philosophy in which Wundt frequently referred to 'Schon Locker.' It was some time before I identified this personage as John Locke.

In appearance Wundt was impressive. He was tall, rather slender, and dignified in his movements and conversation. He invariably wore a black frock coat. On the street his majestic bearing was somewhat marred by a most disreputable soft hat which he always wore. It was apparently a relic of his student days. I can only conjecture that it was retained in virtue of some solemn vow or sentiment.

In conversation he was affable, though somewhat formal. One felt that he was the master. No one of his students would have ventured a joke or an off-hand remark in his presence. He dealt with his flock somewhat autocratically, and prescribed the lines and methods of research rather too minutely. It was characteristic that he never attended congresses or meetings in which he would have met his colleagues on a footing of equality. Yet I never thought of him as objectionably dogmatic, like many other German professors. He was conscious of his leadership. That was all.

I worked in Wundt's laboratory in 1891–92. Fifteen years later, in 1907, I was passing through Leipzig and called on him at the fine laboratory which had supplanted the dingy rooms in the old 'Convict-gebäude.' The janitor took my card and Wundt received me immediately. To my surprise he recalled without hesitation the year I had worked under him and mentioned by name the other Americans who were there at the same time. Remember that every year he had a large number of students, that I had done no special research in his laboratory, that he was over 75 at the time. Is it to be wondered that I was dumfounded at this remarkable exhibition of memory?

In closing let me bear personal testimony to Wundt's influence on the scientific attitude of his students. The exact methods which he insisted upon could not fail to impress those who worked under him and mold their own conception of research. Coming to him as I did from an atmosphere of philosophical speculation, the spirit of his laboratory was a God-send. I owe much to Wilhelm Wundt for the change he wrought in my life ideals. I am glad of this opportunity to pay tribute to him as teacher and example.

Howard C. Warren

VII

I fear I can make no significant contribution to your memorial meeting for Wundt, of whose death I had not heard. I suppose, in common with all others who know the facts, I have considered him, while not the founder, as nevertheless by far the most important prophet of experimental psychology. Not only in the establishment of the

Institute, but in his own continued productivity and in the stimulation of others he has no serious rival.

This is not the time to attempt a critical estimate of his work. Suffice it to say that I place a very different estimate upon its different portions, and regard the work in experimental psychology as altogether the most significant, and as likely to have by far the most lasting value.

James R. Angell

VIII

Wundt's greatest contribution to Psychology will, in my judgment, be not some particular doctrine or experimental discovery, but the impetus which he gave to the entire experimental activity in our field. It is largely due to him that Psychology is taking its place among the important sciences.

But in saying this, one may well appreciate the stimulus which has come from particular doctrines of his, such as his teaching that feelings change in three aspects or dimensions, even though the doctrine itself hardly seems destined to be regarded as true in itself. And one can see that his influence has counted strongly and with great benefit to correct the disproportionate attention given to sensory and cognitive processes, by elevating into importance those processes directly involved in emotion and in volition. Much weight, I feel, should be given to his doctrine in regard to Psychic Causality.

Anyone who worked in his laboratory will remember the interest he took in his students, and the intellectual and scientific stimulus which came from the man. His daily round of the laboratory was looked forward to by his experimenters, and I know of those who were careful that their daily programme should be so arranged that they should always have the benefit of this visit of his. His geniality at his home, and particularly the conversations after his Sunday dinners, are among the most valued of my recollections of him.

George M. Stratton

IX

I studied with Wundt during the spring and summer semester of the year 1894, taking lectures and doing some work in the laboratory. Wundt's quarters were then in the old buildings on the Grimmaische Steinweg, if I remember rightly. Külpe was there then and I worked with Kiesow in the laboratory. Wundt was giving a general systematic course in psychology, which I attended.

When this symposium was proposed I was interested in resuscitating my old note-book with its flexible, black cover and its little blue-margined label saying, 'Wundt—Psychology.' My notes contain diagrams of apparatus and figures which have since become so familiar,—the rotating discs for mixing colors, the tuning forks and resonators, tachistoscope, etc. This and lots of other apparatus Wundt had on a long table on the platform in the lecture room and illustrated his lecture with it. This, of course, was his great innovation. He was a very clear and interesting speaker, easy to understand and easy to follow, even for a foreigner not too well acquainted with the German. I seem to remember that he was very fond of the word 'wahrscheinlich,' which he drew out in a peculiar manner, and the phrase 'psychische Vorgänge,' is suggested to me when I visualize Wundt on the lecture platform. He was always talking of Vorgänge, Ereignisse, Prozessen and Geschehen, as applied to mental life, which of course indicates his point of view, new then but now familiar. "Vorstellungen sind Vorgänge und nicht Gegenstände. Sie sind Ereignisse," as it says in my notes.

An idea, he said, can never come again; it is a new one, just as a Bewegung can never come twice. So as *elements* Vorstellungen will not serve. These old errors I suppose were what he had in mind when he said in an early lecture as reported in my notes, 'Man muss vergessen alles was er weiss wenn man ein Psycholog werden will."

Socially Wundt was very kind and friendly. My sister was then studying in Leipzig, and Wundt invited us to dinner at his home and after the dinner we returned to the drawing room and stood around in a circle and said 'Mahlzeit" and shook hands. I returned to Leipzig in 1897 and heard one lecture by Wundt in his fine lecture room in the new building. There was the usual large and attentive and respectful audience

In later years my interest has been more in Wundt as a philosopher than as a psychologist. Whether he devoted himself to psychology, philosophy, logic, ethics, social psychology, the psychology of language, or even the philosophy of nature, the same masterly hand was shown. This was the wonder of the man. Whether it was the power of his memory or his patient application that wrought all this body of learning I do not know, but his many books display a wonderful encyclopedic knowledge.

That Wundt never said anything foolish or brilliant must have been somebody's witticism based on an ignorance of his work, for he made many brilliant contributions to science and philosophy. To mention only a few, his theories of the increase of psychical energy and of creative synthesis and his emphasis upon the value concept in general have had a development in recent years which must have given him great joy. In this idea of creative synthesis the twentieth century seems to be attaining a complete emancipation from the mechanical evolutionary philosophy of the nineteenth century. Even Wundt would perhaps have been amazed at the extent to which this notion has been carried in the realm of biology, psychology, philosophy, and ethics by writers for instance like Professor Spaulding in his 'New Rationalism' and his daring discovery of 'freedom' at each successive level. This is surely 'the new freedom.'

By creative synthesis Höffding says he meant the capacity of producing a qualitatively new content through a composition of given elements. The modern development of this principle to the position of 'freedom' or that "the limit is not a member of the series of which it is a limit," might have seemed rather mystical to Wundt.

In the history of psychology and philosophy Wundt's name will certainly retain a most prominent place. His physiological psychology, his doctrine of elements, his theory of apperception, his voluntarism, his psycho-physical parallelism, as well as his creative synthesis and his definition of philosophy as a general science whose function is to unite the results of the special sciences into a system satisfying to our sentimental needs and our intellectual impulses—all these and many other original or semi-original contributions assure his standing in the history of philosophy.

Significant also is his long term of service as professor at Leipzig from 1874–1920, forty-six years, and interesting too is the immense body of his writings, embracing according to Hall's estimate about 16,000 pages not including the *Studien*. Even Herbert Spencer wrote less than 12,000 pages and Kant 4,400.

G. T. W. Patrick

X

Wundt was a tall, sparely built man with a slight stoop, a large head and a pleasant face. His features were strong and clear-cut. He wore thick, dark glasses which were the outward evidences of the conditions that made it possible for him to contribute to the literature of retinal pathology from his own introspective experience. He could use only part of one retina during the last half of his life. With this partial visual equipment, he did a prodigious amount of work, both of reading and composition.

He worked with systematic regularity. His mornings were spent at home, where he was protected from disturbances; there he divided his hours between reading, writing, and editorial tasks. He used an American typewriter in the days when I was a student in the middle '90's and was very appreciative of its coöperation, and well he might be.

The first semester I was in Leipzig I waited with great impatience, as all newly arrived Americans do, for notices to be posted by individual lecturers giving the dates when they were to begin. In October Wundt's notice appeared. I could not make out from the handwritten confusion the date for which I had been waiting. I was trying to decipher the document when a native arrived. With hat in hand, in my politest German, I asked his help. I stood near and listened intently so as to make sure that my uncertain command of the language did not leave me in the lurch. It was with mixed satisfaction that I heard his guttural ejaculation, "Mein Gott, das ist nicht zu lesen."

Every morning with his American typewriter Wundt wrote some of the voluminous body of material which remains as his monument. Later, when his eye-sight grew worse, his daughter did much of his writing for him and shared too in his collecting of material.

No one who worked in the laboratory under Wundt can fail to remember the painstaking care with which he went over theses. A part of his morning was given regularly to this kind of work. He edited the *Studien* with personal attention to details and at the same stroke made himself minutely acquainted with the writings of his students.

In the afternoon he took a walk, attended examinations and came to the laboratory. On his arrival at the *Institut* he went directly to his private room, where he held conferences. Once in a great while he would make a tour of the working rooms. He held his lectures usually at four o'clock —well after dark in the winter months of that northern latitude.

Any one who ever heard him lecture will remember the ringing clearness of his enunciation and the sweep of his masterly summaries. He was always vivid and intense. I never ceased to wonder at the enthusiasm which he showed for the details of a demonstration. He would introduce the demonstration apparatus for a reaction experiment and give the steps of the experiment, exhibiting perfect familiarity with the steps of all of its technical complications. Here he was the true experimentalist. Later he would give a review of the history of scientific work in the reaction field, leaving his hearers with a broad, general view which only a master can venture. In some other course he could carry us through the intricacies of logic or ethics or over the successive periods of philosophical thought.

He always spoke with deliberation and emphasis. I remember his telling with great good humor of the permission he once gave to an American girl who wanted to come to his lectures solely because, as she frankly told him, he pronounced his words so clearly. He used a few notes, but spoke freely and always with that symmetry and completeness of style that characterize his writings.

In the old *Institut* lecture room, where he lectured in my day, he had many auditors, but later the number increased. In the new Augusteum he filled the great Aula. I heard him in 1913 when his strong, clear tones were still readily heard in every corner of the greatest auditorium that the new university possessed, though he was in his eighty-third year. Not an empty seat was to be had. His *famulus* at his direction secured a seat for me as a special honor to an old student by dispossessing a regular *zuhörer*.

In personal ways Wundt was simple, even to the point of impressive modesty. He used sometimes to ask those of us who worked in the laboratory to Sunday dinner. His wife was a stately matron, tall and slender like himself. I always thought of her as of the New England type. At these dinners he would reminisce about his American students and plan trips to America which he felt sure he would never take because of the long ocean voyage. He often went in the summer to Switzerland and in the spring to Italy. He thought some day it might be interesting to go to America—but after all it was too far.

I suppose I should never forget my examination, whatever happened, but I look back on it with more than memory for an important day in my personal career. I had done the proper thing of course and appeared at two p.m. in a dress suit and white gloves. The gloves ripped just as I went into the examination—I suppose as a result of their excitement. I doubt whether I should ever have come through if there had not been some very good psychology exhibited on the part of my first examiner. He asked me as his first question what part of the United States I came from. Fortunately I knew the answer to this question. He asked me what I had read of the English School of Psychology. Thanks to Armstrong's training, I had read Berkeley's 'Essay Toward a

New Theory of Vision,' and we were off—gloves or no gloves. I remember two things about that examination,—his praise of Berkeley for using empirical material as the basis of his conclusions and, second, his general management of the occasion so as to let me show absolutely everything I knew. I went away from that table with a view of an examination that had never been so vivid before. I saw it as an opportunity for a candidate to show his best side, not as a dangerous pitfall prepared by a crafty enemy.

Long years after my student days he took me to his home for dinner. His wife was dead and his daughter presided in her place. It was a simple home, in spite of the fact that he was honored as one of the world's great men. Mrs. Judd and I were hospitably placed on the sofa and we talked of many things, of old friends in America, of the progress of psychology, of my work, in which he showed a keen interest, and now and then, when I came back to the topic, of what he had done.

It used to be the tradition in the laboratory that no one should speak to Wundt about any of his forthcoming books. When I heard it whispered about that the 'Grundriss' was about to be published I went to Meumann and told him I wanted to get permission to translate it. He discouraged me, saying that Wundt's disastrous experience with the French translation of the 'Physiological Psychology' made him unalterably adverse to translations. The difficulty was that the French translation was not revised and so, while the German editions had twice been worked over, French writers were quoting from the original form as it had been embalmed in the French. But I persisted and went to the publisher with the request which I was told not to venture with Wundt. The permission came in the form of a proposal that the translation should be made under Wundt's personal observation and should be printed in Leipzig. In this way I had half an hour every Thursday with Wundt during the spring of 1896. He read all of my proof and commented on it. He found I was off the track a number of times and he made me defend my terminology in a good many cases. I remember a long discussion on my translation of *apperception* and *perception.* I persuaded him that the English word perception was not what we wanted. That discussion was in his mind seventeen years later when I dined with him at his own home.

I remember bringing him an American review of the 'Grundriss' while we were consulting on the translation. It was by one of his former students. He looked it over, laid it down and said, "Some people read superficially, do they not; it would be difficult to misrepresent a book more completely in an equal number of words." The review did not irritate him in a personal way, so far as I could see, but he was justly drastic in his criticism of its superficiality.

I always found Wundt absolutely objective. I have read the controversial writings in which he took part and I know of his dislike for our great James's views. I know it is said that he felt keenly the dropping away from him of some of his most notable students. I have read his comments on the war and I have great difficulty in placing them in my thinking of him. I am disposed, for my part, to attribute all his scientific quarrels to his sensitiveness and modesty, and his devotion to truth as he saw it. I do not think that in scientific disputes he was partisan for personal reasons. He was absorbed in fact and wholly committed to what he believed to be the correct interpretation. The Wundt I knew never was anything but strictly empirical and objective.

One example, and I think a typical one, of his complete devotion to empirical science came to me in connection with my thesis. Wundt was going over the document in a conference with me, surprising me beyond degree with his familiarity with its details. He pointed to one paragraph and asked for the evidence justifying my conclusion. I did not have any very impressive body of observation to which I could appeal, so I stoutly asserted that it seemed to me '*a priori* wahrscheinlich.' He turned on me with the final and demolishing remark, "*A priori* ist gar nichts wahrscheinlich."

Of his writings and his contributions to science this is not the time nor context in which to attempt to speak. I have tried to read everything he ever wrote. To me his stimulating thinking has been a source of constant inspiration. I have no trivial comment and no adequate praise with which to express my personal indebtedness to the great movements in psychology which originated directly in his works.

Charles H. Judd

XI

It is with regret—and chagrin—that I realize that any little contribution to the Wundt memorial meeting that I might have hoped to make is now too late. I can offer as my apology only the fact that press of affairs in connection with taking up my new work at Dartmouth and getting settled in my new home put the matter temporarily out of my mind.

Though perhaps not in a position to judge adequately Wundt's contributions to psychology, I should have had some personal reminiscences which it would have been a pleasure to send, my admiration for the grand old man being very great indeed. But the opportunity being past, I can only express the hope that your celebration has been successful in every way and congratulate you on your contribution towards the restoration of the bonds of international science.

Wilbur M. Urban

XII

One recalls Wundt well after twenty-five years, his strangely awkward movements, his rugged, farmer-like, fatherly presence, his keen but genial glance, and his head turned slightly to one side to bring one squarely into the focus of his one good eye. He gave the impression of being fairly tall, slightly stooped and thin, like an ascetic, but he was vivid, eager and human as ascetics never are. He usually wore a dark grey suit, his thin full beard was slightly grey beneath his prominent cheek-bones, and above his spectacles (with one of the lenses semi-opaque) he wore a soft black broad-brimmed hat. His rather quick angular movements were somehow redolent with a fine, almost solemn dignity;

and yet he was always quick to see a joke and often smiled as he conversed. Indeed his heart seemed younger than my own; it was the heart of a sensitive, happy boy. Geniality and fatherliness were the most obvious characters of his attitude toward us.

His handwriting was almost unbelievably difficult and awkward, but not unpleasant to read. His hair was thin above his forehead. His voice was deep, but somewhat husky and nervous, as though it were a bit difficult for him to summon and control it; and yet he always seemed the soul of gentleness and good humor when he spoke to one and he was fond of genial conversation. With possibly one exception, I believe all his special students were fond of him, as I was. He was quick to excuse the shortcomings of others. Of a colleague who was cutting his classes, he said, "He is much worried concerning his son," and went on to explain the nature of the boy's illness as though Wundt himself had been the physician in charge of the lad.

Hence I was thoroughly surprised and mystified by his answer to my question, "Do you think France and Germany will ever again be at war?" It was after a Sunday dinner in his home. His voice was almost raucous with mirth as he replied, "*Oh*, ja!" as if the prospect, or certainty, were pleasant to contemplate! It seemed utterly at variance with my impression of him, as does today his utterance in October, 1914.

It was rumored in his laboratory that he could be very hard toward anyone who joined issue with him concerning any of his published doctrines. When Külpe's *Einleitung* appeared, Wundt promptly published in the *Philosophische Studien* his article on *Der psychophysische Materialismus*, the name which he labelled Külpe's doctrine of mind and body, —and Külpe had been until recently Wundt's first assistant. I had heard him say that it would probably be a good thing if Germany passed a law excluding all foreign students from her universities, on the ground that they acquire only a smattering of German, "not enough to enable them to read understandingly, for example, the *Philosophische Studien.*"

He had a horror of being misunderstood and misrepresented, as who has not? But he no doubt lived in his intellectual activities to a rare degree; he probably identified himself with the children of his intellect as few men do: certainly he had a rare capacity for intellectual drudgery.

A Serbian who was Wundt's *famulus* was once discussing with me what I claimed to be a characteristic of American young men, namely, the effort to live up to a self-chosen standard of personal morality whether the customs of the community required it or not, when Wundt came into the room and Herr Arrer explained to him my thesis. '*Der americanische Idealismus*,' commented Wundt, and laughed gently at my expense. He distinguished between *Sittlichkeit* and *Sittsamkeit* and applied the latter name to the attitude in question. This would seem to be in accord with his own Kantian doctrine of the formal character of duty, the content of duty being determined by customs and circumstances.

No doubt it is true that Wundt's personality was not profoundly ethical: his gentleness *was* paternalistic, not fraternal. He was thoroughly partisan in most of his public interests, and perhaps that is why he seemed to *live* in every structure of his body and mind as few men succeed in doing. Concerning the great philanthropies of American capitalists, he once remarked that German men of great wealth would not as a rule give so lavishly. "Das wäre ein Reichtum!"

Even in his thinking he seemed to strive to be logically consistent with his own intellectual past. Yet, in his partisan way, he revered facts. I once took him the results of some experiments on the two-point illusion (*Vexirfehler*) in tactual perception. After glancing over my tables his comment was, 'unmöglich!' I made bold to ask the privilege of experimenting on *him*, and to my surprise he readily allowed me fifteen minutes out of his daily *Sprechstunde* in the laboratory. At the end of three weeks he asked, "Nun, Herr Tawney, was haben Sie gefunden"? I explained that, for the most part, I had been touching his arm, not with compass points as he supposed, but with cards of various lengths, and he thereupon asked me to write up the experiment, the results of which he had pronounced impossible.

In his lectures he spoke slowly from brief notes. There was a serene work-shop atmosphere in his hall, and although he spoke slowly and with a slight suggestion of weariness in his voice and manner he was never at a loss for words. All his classifications and definitions were perfectly articulated: indeed I believe a greater genius for classification never lectured on psychology. His mastery of his materials was complete,—too complete. The impression I retain of him is that of a master of the art of academic exposition. However, beyond setting for us a pattern to be copied, he did not stimulate thinking. He thought for us: there were no problems left over for us to try our teeth on. Lotze must have produced a very different effect upon the minds of his hearers. Nevertheless Wundt was the most popular lecturer in Leipzig in my time, and the range of his lectures was extraordinary, including jurisprudence and the history of philosophy along with his systematic courses in logic and other philosophical and psychological disciplines. In fact, the wide range of his intellectual mastery was and is amazing, and there is in it a rebuke for the tendency of so many of the newer American colleges and universities to departmentalize and so specialize the work of academic instructors.

His memory seems to suggest that it is not at all impossible that a single individual should master the greater part of the scientific tradition of his time. And yet, a favorite maxim of his was, "Beschränkung macht den Meister!"

G. A. Tawney

XIII

The invitation to take part in your memorial meeting, received on my return from France and Italy, contained a note of deep regret for me, since it was the first word to reach me of the death of my old teacher and friend, Professor Wundt.

It sent my memory back a score of years to his study where he lived and worked. Thirteen tables and desks of all shapes and sizes I believe there were in that sanctum—high, narrow, bookkeeper's desks and low, squat ones, and a big, round center table and a new, very American stand with a typewriter on it.

The scene presented a perfect orderliness, but I happen to know there was an adjoining lumber-room where reigned a perfect chaos of dusty books and pamphlets, that always suggested to me the vasty reaches that lie, in the Kantian transcendentalism, beyond the limits of human experience.

The last time I ever saw Professor Wundt was in this room, where he demonstrated to me his newly acquired proficiency on the typewriter, a one-finger exercise to be sure, but not without great gain over his laborious process of writing with an inch-long pencil under the permanent handicap of writer's cramp.

How he maintained such titanic productivity in his literary work was a mystery to us all in those days, but the wonder of it has constantly grown through the years. How with that muscular defect and his pathetically poor eyesight behind dark glasses, he ever carried on unaided the mass of his writing is truly beyond my comprehension, as a mere feat of quantitative production, apart from the quality of the output.

When you ask me what I consider to be one of Wundt's greatest contributions to psychology, a great many of his achievements spring to mind. Of course, historians of psychology will emphasize his service in putting the science on an experimental basis and of establishing the first psychological laboratory. With all modesty and no claim to greatness, we psychologists in America, his followers, might say he contributed *us* and our psychological laboratories.

Apart from these, however, if you want a personal opinion, I must say that the greatest single contribution of Professor Wundt's intellect to me consists in his work and his methods and conclusions in regard to the Human Feelings.

More definitely than any of his predecessors, I think, he grasped the difficulties, logical and experimental, that one must meet in the investigation of the problems of the feelings. He recognized their position on the extreme borderline of possible scientific treatment.

Our Intellect, being our only instrument whereby scientific knowledge can be extended, appears ill-adapted to achieve a mastery of these phenomena. Wundt recognized the dangers in analyzing and classifying the feelings according to any of the familiar standards of scientific method, also he gave full credit to the feelings for their almost infinite variety, while he deplored the poverty of our language over against the necessity in the science of feeling of meeting the general scientific requirement as to accurate and full recording of results. Nor was he unmindful of the extreme difficulties to be overcome if really trustworthy experimentation is attempted in the region of the feelings and emotions.

But with full recognition of the difficulties and dangers, knowing well that the intellect is very apt, when the feelings are presented to it as subject-matter, to distort them, to convert feelings into ideas, which most assuredly the feelings are not, nevertheless he succeeded in advancing the problem more than any other single investigator and laid out a workable plan for guidance of future investigators in that province.

His work was mainly in the analysis of the feelings, the objects which in all the world are probably the most refractory to logical analysis. He did much to establish Feeling in its proper relations to Intellect and Volition; and he did still more by his treatment of the Emotions. This appears to me to be the spear-point of all the Wundtian theory in the sphere of psychology, and that which is most likely in the future to advance our knowledge of the Life of the Spirit.

EDWARD M. WEYER

XIV

My conception of Wilhelm Wundt is that of an inspiring teacher, a man of remarkable ability, and untiring industry and complete devotion to his work. Wundt was a man of very great width of vision, and made contributions in more fields than any other psychologist, I believe.

When he began his work psychology was thought of as a branch of philosophy. His work changed it into an experimental science. This last service may well be regarded as his chief one.

WALTER DILL SCOTT

XV

During the year 1906 the writer spent a summer session in Leipzig and attended Wundt's large lecture class, consisting of probably 200 students, who filled every available space in the room, several finding it necessary to stand throughout the lecture. No roll was called, no questions asked, no attendance taken and no grades given aside from the signing of the report book at the end of the summer term, as was the usual method of procedure in German universities. In accordance with the German custom, all students assembled before the lecturer arrived and when he entered there was a pronounced shuffling of the feet on the part of the students and a courteous recognition on the part of the professor. The class always considered Wundt a dignified, autocratic type of professor who valued formalities, and frequently spoke of him as *Herr Geheimrat Professor Doctor Wilhelm Wundt.* Professor Münsterberg held a similar opinion, and perhaps the writer was prejudiced in advance of the visit to Leipzig. Wundt was much less formal in his own home and kindly signed the photograph of himself which accompanies this article.

At this time (1906) Wundt was very much stooped, with poor eyesight, being 75 years of age; he lectured with a whispering voice which was difficult to follow in the large lecture room. The writer was much impressed with the careful, detailed analysis that Wundt always made and the fact that he always illustrated his lecture by means of experimental demonstrations whenever possible. Our laboratory experimentation at this time was in charge of Professor Wirth. Wundt was a great philosophical psychologist who had made the approach through the sciences of physiology and physics. Wirth was a careful, technical, laboratory type of psychologist.

In regard to accrediting Wundt with establishing the first psychological laboratory in 1879, as so many authorities do, it should, of course, be recognized that Weber, Fechner, Helmholtz and Wundt, in earlier experiments in psychophysics, anticipated this date. In America James, who had never studied with Wundt, was giving in 1875 a course in psychology with experiments, in Lawrence Hall at Harvard. James also used experimental demonstrations in his lectures on the physiology of the senses at Johns Hopkins, 1877–78, where Hall and Royce were his students, Hall later attending Wundt's course in Leipzig in 1879–80.

Bird T. Baldwin

XVI

Wundt was well above seventy years of age when the last group of Americans, of which I was one, received their assignments to places in the laboratory in which a long list of distinguished psychologists had received their inspiration and training. Although this was fourteen years before his death, I remember the general feeling of uneasiness which pervaded the laboratory group, a feeling of apprehension, that the aged philosopher would not survive our period of residence at the university.

The cosmopolitan character of Wundt's degree students is a fair indication of the extent to which the reputation of the old laboratory had traveled.

In 1906, at the age of seventy-four, he assigned personally twenty-three subjects of research to as many candidates for the degree. The candidates were assembled in one of the rooms of the laboratory and, after a few introductory remarks the subject of investigation for each candidate was announced, together with a brief exposition of the thesis. The clearness of Wundt's mind at the advanced age of seventy-four, his general vigor and direct attitude in the assignment of each of the doctorate dissertations, lingers in my memory as a classical illustration of the fallacy of age retirement.

Wundt not only assigned the various theses but personally directed their development and finally approved or disapproved them. In approval and disapproval Wundt exhibited the well-known German trait of guarding zealously the fundamental principles of his standpoint. About one third of my thesis failed to support the Wundtian doctrine of assimilation, and promptly received elimination. Whatever may be the merits of German scientific dogmatism, it is no myth and flourished in undisguised fashion in the laboratory at Leipzig.

The reputation of Wundt secured for him a peculiar kind of reverence, a species of deferential treatment, which the German and certain of the foreign students easily created but which the American student could not readily understand. It was altogether common to observe a small group of the 'intelligentia' often from remote corners of the earth, waiting for His Excellency to pass from the laboratory down the corridor to his lecture room. Disappointed ones were directed to take position at a certain place on Thomas Ring which he was known to pass daily with clock-like regularity. His signature was eagerly sought and was already merchantable in the hands of the professional collectors.

Wundt, in common with the rest of the German intellectuals, regarded with skepticism the English and American forms of social organization. His attitude and action during, and before, the World War are consistent with his belief in German Kultur. I prefer to pass this over and retain my picture of him as the modern Aristotle with respect to versatility if not with respect to originality. The wide sweep of his pen will endure in the records. His charming personality and kindliness of manner in surveying the progress of researches by foreigners, struggling with scientific German, must always remain an essential part of the memory of Wilhelm Wundt by those who were privileged to meet him in conference or share his hospitality.

George F. Arps

XVII

I was a student at Leipzig for two years, 1909–11, and during this time I took much work under Wundt. I regard Wundt's systematization of the field of psychology as his most important work. For the first time Wundt gave us a system of psychology, and even although many of us may not agree with the system at the present time, I feel that it has been a great contribution to psychology.

In addition to this I feel that Wundt is to be credited with the encouragement of experimental work in psychology. It is to his influence that we can trace back most of the experimental work of the last thirty or forty years.

Wundt's decided interest in philosophy and the philosophical applications of psychology seem to me to have diverted him from the growing field of applied psychology and he was always more or less indifferent to this field. He cannot have been said to be antagonistic but he certainly was not enthusiastic about it. This even applies to the field of experimental education and I remember in Leipzig a warm discussion upon that point. Wundt eventually came out in support of the new Pedagogical Laboratory, and there was great joy among the teachers when he did so.

When I was at Leipzig, Wundt was of course advanced in years and he himself was not doing very much, if any, actual experimental work. His lectures were always crowded and the cosmopolitan make-up of his audiences was striking. Indeed it seemed to me that there were more foreigners than Germans in his classes. This certainly was true in the laboratory, during the two years that I was there. What struck an English student was the great respect and deference shown by students, professors and assistants to Wundt. To some of us this seemed to go to a ridiculous extent, but he himself took it all very much as a matter of course. As contrasted with this, was the fact that when we needed a laboratory key we had to see the 'Herr Geheimrat' himself and pay him our deposit of a mark or so. I mean it seemed so foolish for a dignified individual, such as he was, to trouble himself about such minor details. What impressed most of us was the ease with which he lectured and the clearness of his exposition in the class room, which was such a great contrast to the involved manner of his books. He always held the attention and interest of his classes and seemed himself to come to his class well prepared and deeply interested.

Wundt always struck me as very unemotional and as such he probably lacks the enthusiastic friendships of other great teachers. No student seemed to get very close to him. His cold intellectuality seemed to make them stand back. I translated his short 'Introduction to Psychology,' but even in the necessary correspondence for that work I did not seem to approach any nearer to the man himself.

I was not at all surprised at the outbreak of the war to find Wundt lining up with the Pan-Germans. Although never expressed openly, it seemed to me in line with his attitude as to the greatness and excellence of German scholarship and, therefore, everything else German. I understand that this German attitude of his existed to the end. This narrowness of mind in a man who obtained distinction as a philosopher was a distinct blow to many of his students, and I am sure it led to a diminution of enthusiasm for the man himself, even although it could not diminish their respect for the psychologist.

Rudolph Pintner

THE STRUCTURE OF ANIMAL LEARNING

BY J. A. MELROSE

Janesville, Wisconsin

I. The Problem

The task of clearly objectifying the learning process has proven a difficult one—more than ordinarily so—and for reasons some of which are quite clear. Jennings warns, "Each of us knows states of consciousness only in himself," and yet that we readily yield to the temptation to project our mental states into our interpretations of observed learning, needs no evidence beyond the literature upon the subject of animal learning. From so general and so subtle an error we can, it appears to me, hardly hope to escape even fairly well except by giving rigorous attention to the structure of behavior.

What do we mean by the structure of behavior? Professor Watson defines psychology as the science of behavior, by which I understand him to mean that psychology is an orderly statement of the principles and laws of behavior. This is what I mean by the structure of behavior. For it is of course assumed that the laws of psychology are not arbitrarily imposed upon the facts of behavior, but rather that they merely shape in language the generalized forms which lie hidden within the total of behavior with which descriptive psychology has to do. In order to keep our eyes upon structure in this sense, and to disengage inherited from learned structure, it is well to begin with lower animal forms, where learning is grafted upon very simple inherited behavior and where the imagination is least tempted to take the wing.

But even if we avoid unwarranted assumptions with respect to consciousness in animals, we are not yet done with problems which arise within ourselves. The hidden technic of our own method of reflective learning, together with its freight of learned associations, are ever insinuating themselves into a product which we think of as wholly objective; for when we are in the act of observing and interpreting our observations, a great organized store of subconscious associations are ready at the slightest unobserved hint to slip into place in our thought, so that truth which we think we have caught in the external world of fact relation may in truth have been largely 'seined from the deep sea of our own associative memory.' What we really see is ourselves. It is only another case of seeming 'to see behind the looking glass.'

It becomes therefore very easy to assume that the adaptive behavior of an animal low in the biologic series is due to consciousness or some intelligent grasp of his problems. Such an interpretation is natural to us and is often extremely plausible. It is not strange therefore that the marked fact in the development of animal psychology is that from the beginning continued pressure has been needed at every point to squeeze out the error that comes from assuming in animals the high states of consciousness and methods of learning which we ourselves possess. There seems to be no good reason to believe that this purging pressure has as yet done its complete work.

By no means the least of our general difficulties, and one that calls for closer attention to the structure of learning, is the state of terminology in comparative psychology. We still employ such words as learning, association, intelligence, reason, consciousness, attention, purpose, etc.—words which bear the major weight of meaning in psychology[1]—without definitive clearness for the most part. In popular thought these words carry a more or less nebulous meaning which gives them currency. In scientific usage we slide them into gearing to do work in different shades of meaning within their general popular connotations. This is done without definition, or by definition confessedly arbitrary. This adds nothing of clearness to comparative psychology, but as be-

[1] We should except behaviorist psychology. Professor Watson in his 'Psychology from the Standpoint of a Behaviorist' discards 'consciousness, sensation, perception, attention, will, image, and the like' and believes they are not missed.

tween the higher and lower levels of psychology, leaves the position of those who hold to larger psychic content for any particular term, and that of those who hold to lesser content, free, as James says, 'to eat each other up to all eternity.' There is insufficient analysis behind our terms and therefore comparative psychology is dependent upon language whose meanings are too vague and general to suit the demands of the positive method.

This vagueness of terms is no doubt in part unavoidable, for it is the perpetual dilemma in the progress of every science, that, while terms must carry as clear meaning as possible, the last and not the first stages of a science, are the definitive stages. However this looseness in the use of terms seems to be in part due to a vicious tendency to impose upon the whole process of learning, descriptions which, at most, are applicable only within restricted limits. Such a word as consciousness, for example, which gets its meaning from the higher human levels, is credited by some philosophic psychologists with the integrating function, which function is found at work also in the very lowest animal forms. On the other hand a too objective view of certain behaviorists, gleaned from observations on the lower levels, is pushed violently up and overworked in duly logical fashion to explain higher learning processes where words of larger psychic connotation are clearly demanded by the facts. Whatever leaning any writer may have with reference to the problems of comparative psychology between these two extremes, his bias slips surreptitiously into his terms so that it is often difficult to be sure of the exact position of any writer whatever.

Now if on the one hand we are to describe, for example, the most primitive integrating tendency of organisms as especially due to consciousness, or on the other hand describe conscious learning by, say, the local action theory of Loeb, or the refined muscular activity of the behaviorists, it is well to note just what we are achieving in such description. It is probably indifferent whether we describe consciousness in terms of biochemistry and physiology, or biochemistry and physiology in terms of consciousness, if we can do either without violence to the facts. Merely stretching one set of terms so that its connotations include the other set, is not making progress however; while to make terms mean so much is quite sure to make them mean not much of anything. Moreover such a transporting of terms from their origin and clear meanings to a realm where they become but vague symbols turns the cutting edge of all clear thinking. What are wanted are the coördinating points which will fix organic learning and conscious learning with reference to one another. Meantime it is better to hold to both consciousness and concomitant bodily reaction, despite any sense of dualism, than to have either one swallow more than it promises to assimilate.

Learning or adaptive modifiability of behavior on the basis of experience begins far down in the animal series and extends up to the reflective learning of man. What can put an end to the confusion which comes from the skidding of undefined terms up and down this learning incline? As we study this learning process how shall we be able to eliminate from the objective product our own projective states and the reflected structure of our unanalyzed method of learning? These are general problems which we have in our tools, beyond which is the problem of the complex facts themselves.

These facts are very complex and hard to isolate. Even the reactions of the 'naked mass of protoplasm' of unicellular forms are very wonderful. As we go up toward higher learning the simple reaction types of lower forms seem to be scrambled together in varied relations. This gives to the problem an inherent complexity, which, since it does not show in movements, is often overlooked. The individualizing tendency of organisms and the resulting unity and seeming simplicity of movements—even those which involve many parts of the animal—give to behavior a deceptive smoothness which has thrown many off their guard. It is therefore not uncommon to find the behavior of even higher animals interpreted with running comments of a thoroughly easy-going sort. This will not do. We must give weight to the difficulty of the problem despite the deceptive smoothness of movement due to the general integrating power of an organism and its tendency to fuse elements and cover up joinery. Very complex technic appears to issue in very simple smooth behavior.

The difficulties mentioned above conspire to vitiate the importance of animal psychology as a descriptive science. As such it furnishes us with no standpoint from which we can clearly assess our terms, and no means by which we can get the thin edge of a distinction between the truth and a plausibility that has had too easy currency. The study of animal behavior must be pushed forward by attention to quantum (repetition) and relation, which can alone bring a science beyond the descriptive stage. Behavior, especially novel behavior, is interesting, but the structure of behavior—that which is inherited and that which is learned—is more significant. What we are after therefore is that which is repeated, that which can be generalized—that which is mechanistic if you will. We seek in other words that which has structure, and the technic by which it develops and by which it functions.

A search for mechanism here ought to be marked by vigilence and modesty too. We do not need to accept a contract to explain everything. As James says, "The special natural science of psychology stops with the mere functional formula." This does not justify selecting out only those facts or aspects of facts which lend themselves to easy mechanistic treatment, to the exclusion of all others, as it seems to me the thorough-going behaviorist does. Nevertheless at a certain point we accept our data uncritically, and leave it to metaphysics to raise the previous question. But if it is well for psychology to have the control neither to discard troublesome facts because they are troublesome, nor yield to the natural strain to foist our mechanistic conceptions in some manner upon the facts, it is equally good to have the clearness to see that where our discovery of mechanism ceases, there true scientific progress is necessarily at the dead point of the wheel.

All this seems to point to the advantage of attempting to isolate the different types of learning which enter into the learning process from the lower to the higher levels, in order that each type may be held up separately and its structure carefully examined and analyzed. This paper sets out to make a beginning upon this task. We do not begin with lower learning because this is assumed to be more illuminating in itself. We carry no preconceptions that explanations of animal learning will all but exhaust the technic of learning. On the contrary, such a beginning in the lowest learning and limit in animal learning, merely follows a certain serial order and natural division which the problem presents in itself. A fairly successful analysis within this lower field should furnish a background, clear the perspective somewhat, and eliminate some of the difficulties in the way of the more difficult task of analyzing human learning.

II. The Lowest Animal Learning

Learning which we have defined as modifiability of behavior on the basis of experience, is found at the very base of the animal series. On its lower levels learning consists of defining, selecting, and modifying instinctive and random movements. These movements are prompted by stimuli arising in the physical condition of the animal and from the conditions of the environment. The reactions, therefore, upon which learning is grafted are sensorimotor responses and their resultant feeling; the latter on the lowest levels being little more, it seems, than release from stimulation. At any rate the avoiding reaction is primitive and the very lowest forms are limited in their reaction systems to this. Negative reaction therefore appears to be primary and to furnish the base upon which positive reactions are built up.

Learning by direct sense-stimuli is a method which of course continues to function as we go up toward higher learning, but this basic method is added to and improved by means of better structure for both transmission and articulate movement. Our task as we have shaped it is to set forth in order the types of learning which make up adaptation in the animal series. If we can do this and account for the function of each in the learning process, we shall perhaps be able to clear the ground as we go and so eliminate some of the problems which now beset the analysis of human learning.

Type A. Organic Fixation

When we say that an animal displays random movements we do not of course mean that these movements are entirely undetermined. On the contrary each species has its peculiar reaction system, and is limited to whatever repertoire of reactions it contains, or can be shaped to by learning. In higher animals the reaction system comes in a plastic state and is subject to wide changes by adaptive learning. In the lowest forms however this system is very simple in so far as it represents articulate movement at all.

The very first step in learning is the fixing of the reaction system, which in some forms appears to be in the early natal life more or less unsteady and inarticulate. The repeated discharge of the primitive reactions of the organism defines and fixes the system by practice. For example this type of learning can perhaps be best seen in the embryos of fish which first lie on the dorsal side but begin early to try to lie on the ventral side when they swim. The tendency to right themselves occurs in brook trout according to Paton (1907) when they are thirteen or fourteen millimeters long. He does not believe this behavior to be due to the nervous structure, but rather to the position in which the embryo lay in the egg, the shape of the body, and the propulsion of the water. G. M. White says in 'The Behavior of Brook Trout Embryos,'[1] to which I am indebted for Paton's views, that the behavior of these embryos with respect to this matter may be summarized as follows: "The brook trout which has just hatched swims with a whirling movement. About the fourth day after hatching the trout commences to swim in a spiral course, and from then on the movements become gradually better coördinated, the trout swimming in larger circles, and going straight ahead for greater distances."

In all the earliest exemplifications of this type of learning, such as that just mentioned, the process runs along parallel

[1] *J. of Animal Behav.*, 1915, 5, 44–60.

with the process of maturation and it is not clear in any case just what is contributed by heredity and what is due to learning. Some will no doubt claim that the process of ordinary maturation is adequate to explain the behavior, and the excellent coördination of the reaction systems of some animals when they are born gives to this view plausibility. Nevertheless it is placed on the defensive before the general fact of the stamped-in effects of movement. Jennings found in lower forms that any movement once produced is more readily produced again. There is therefore no good reason to assume that the prenatal and early post-natal movements are without any effect upon the organism. I believe these movements do effect the maturing of function. Such a view of learning seems to be legitimized on the same grounds as other views of learning, until at least it is proven not to take place. At any rate this type of learning is so common in higher learning that we are justified in assuming on the general grounds of the stamped-in effects of movement that the early movements of embryos function with the process of maturation in tightening the animal's reaction system.

We have set this type down as the first step in learning, not alone because of its very simple technic but because among many lower forms learning consists perhaps of little more than this fixing by repetition and practice of the simple mode of behavior which came in outline as the motor inheritance of that particular species. It should be noted that the mere discharge of an inherited reaction does not in itself constitute learning, for this reaction may be already fixed and the reaction may be random and may lead to no new adaptive power. This fixing of the reaction system by practice does however mark a real adaptive gain. It lays down no new behavior but speeds up or supplements the process of maturation, and so brings better control over the behavior which the organism already has. We shall describe this first type of learning as *the defining and fixing of inherited behavior by practice.*

This first method of learning reveals no accommodation beyond the fixing process itself. No novelty is introduced into behavior but on the contrary modifiability is all in the direction of inherited motor tendency. Two facts with reference to this fixing process deserve to be chalk-marked. In the first place the fixing is dependent upon 'trial' or repetition. The reaction system gradually becomes stable by repeated discharge. It is clear also that this result depends upon interaction which goes on within the organism itself, by which the final learned reaction is a middle term between the wobblings to this side or that which make up the respective 'trials.' In the example of the trout embryo above the wobblings are especially marked in the first incoördinate stages and gradually improve from a circular one-sided movement to a spiral rhythmic movement and finally into a straight course. This improvement appears to be due to a progressive tightening of the bilateral control of the organism by means of a process which integrates the effects of the repeated trials.

We should note that in this very first type of learning there is not the mere stamping-in of effects as we are perhaps tempted to think. There is not simply repetition and effect. The stamping-in process would be helpless for learning if it stood alone and unassisted. That there is such a stamping-in of the effects of the repeated discharges is clear, but it is the process by which these effects are assimilated in the learned reaction that is of first importance to learning. This process of assimilation is more than integration of effects. The effects seem to be corrected to one another with reference to the total functional end. They are harmonized to the whole and integrated. The final learned reaction is projected in behavior as a result of this assimilative interactivity of the living tissue.

This simple mode of learning continues to be important throughout the animal series, including man. Many instinctive reactions of animals and man come in plastic state and must be fixed by learning of this sort, although other types of learning also enter into the process as we go up to higher forms. Probably this method is found in primal simplicity only in the embryonic stage of lower forms and elsewhere is more or less complicated by other types of learning which fuse with it. However, it continues to be a very important factor of all grades of learning even though it is often hidden amid the complexities of behavior. The baby learns to hold his head steady; the child to fix his A-B-C's and natural numbers; and the philosopher to give an orderly statement of the points of his system by employing the fixing method, although, as we have said, as we thus ascend the scale of intelligence we make draft also upon modes of learning other than this. Nevertheless the ground plan of the process continues to be the same fixing toward a functional end of the subject himself by means of repeated trial and the elimination of error on this side and on that.

Type B. Organic Spacial Accommodation

The simple problem of lower animal forms is, as we have suggested, either movement, prompted by the organism itself, over a path free from unfriendly stimulation, or movement to bring relief from stimulation from the environment. In the solution of this problem animals very low in the biologic scale make some advance upon the basis of experience beyond the mere fixing of their reaction systems as mentioned above. Experience introduces some novelty into their behavior, achieved in accommodation to their environment. Repeated stimulation from the environment causes the animal to eliminate certain movements or change their direction, thereby increasing adaptation.

Let us describe this first phase of environmental adaptation in the most objective way and then analyze it somewhat. We shall call it learning by *the repetition of direct sense-stimuli and the assimilation of the result.* When an earthworm, for example, no longer turns to the right after having had repeated contacts with an obstruction on that side, he exhibits this type of learning in simple form.

Given the repeated contact stimuli from the environment, this type of learning is dependent upon the power of the living tissue to make an organic synthesis upon the basis of the loci of the points of stimulation. Of course the intensity, frequency, and recency of the stimulations affect the reaction but only with reference to the relative rapidity of learning. The direction of the learning, and that is what we are interested in, is determined by the location of the points of contact. It is clear that the repetition of stimuli which this type of learning requires, demands some sort of rough uniformity in the environment. The learned behavior which is finally projected follows a path which has been accepted through the elimination of certain movements and directions. The repeated trials and unfriendly stimulations leave open freedom of movement, for example, to the right or to the left of the source of stimulation, or through a course between opposite sources of stimulation.

If we look too casually at this learned behavior—the process and the final result—the description of 'trial and error,' or 'trial' seems to be adequate. This is true, however, only because the most significant point in this mode of learning is not always apparent in behavior. An animal which, for example, after repeated stimuli on the left side no longer turns that way, does not appear to act so differently from an animal which after repeated avoiding reactions and slight turns to the right, passes safely by an obstacle in his path. Both of these cases show 'trial' and achieve success. In short as objective behavior they look very much alike. Nevertheless in their inner technic these two cases may contain all the difference which lies between adaptive learning and fickle chance. The description which we are offering therefore calls attention to the interaction within the organism itself and by this means enables us to get a more discriminating objectivity than that contained in the notion of 'trial.'

This fact will become clearer if we lay this learning out in its most meaningful exemplification, where the possibility of 'trial and chance adaptation' are necessarily eliminated. If for example we view over against its final learned pathway, the repeated attempts of the earthworm to pass down a narrow alley, subjected to slight electric charges on either side, we may see this mode of learning of type B laid out in clear pattern. The interaction of the organism is now clearly objectified in behavior. The animal first moves in a zigzag course from side to side because of the shocks received whenever his body comes in contact with either side of the alley during his exploring movements. After repeated trials however his course approaches a straight middle course between the two sides.[1] It is very clear that as this process goes on, the effects of the stimuli are assimilated by the organism, and that the middle course selected is the projection in behavior of this synthesizing process.

It appears therefore that the notion of 'learning by trial' is not a very significant description of learning. It fails to locate the frontier boundary between learning and the 'no man's land' of chance. Jennings describes as typical of paramecia the following behavior: "An individual swims against it [filter paper], gives the avoiding reaction in a slightly marked way, swimming backward a little. Then it swims forward again, jerks back a shorter distance, then settles against the paper and remains. After remaining a few seconds it may move to another position, still remaining in contact with the paper. Then it may leave the paper and go on its way." Now the paramecium so described has made trial in his own exploring way and passed on; but while its behavior has shown a good deal of apparent adaptation, there is no evidence that it has learned anything. On the contrary, it is apparent that bacteria may by repeated kickback reactions and successive turns to the right or left adapt to obstacles in their path and so succeed by 'trial,' but the simple reaction systems of these organisms appear to do no better after a thousand trials.

The widely used description of 'learning by trial' therefore needs further analysis. Trial is not the significant fact in learning. There may be trial without learning. In the first place, animals which appear to be incapable of learning beyond the fixing of their reaction systems make trial in the usually accepted sense, and beyond this depend

[1] R. M. Yerkes, 'The Intelligence of Earthworms.' *J. of Animal Behav.*, 1912, 2, 332–352.

on chance adaptation. On the other hand an individual with acute power of learning might make many 'trials' and learn nothing. There are two requisites for this type of learning apart from which the notion of 'trial' is irrelevant to learning, and functions only in the realm of chance. Both of these requisites are clearly supplied in the example we have given of the earthworm adapting his movements to the alley. In the first place there must inhere in the stimuli that which makes them capable of assimilation or synthesis. Put in its most general way this means that there must be some sort of uniformity in the environment to which adaptation is to be made; for no other environment could furnish stimuli capable of being assimilated. Still more interesting for our purposes is the other requisite, that the animal shall be capable of making this organic synthesis of the effects of the stimulations. These two requisites are what lift 'trial' and 'searching' above pure chance and give that adaptive progress we call learning. We have therefore marked these requisites clearly in our description of this learning as the repetition of sense stimuli and assimilation of the result.

A word ought to be said at this point with reference to the relation between type of learning A and type B since they are especially foundation types. Professor Warren in his 'Human Psychology' appears to have been the first to distinguish between these two types of learning as they appear in human learning, under the terms 'fixation' and 'aquisition.' This is a very fundamental distinction in learning. Nevertheless when we get clearly in mind the method of description which we have applied to these two methods of learning it is clear that the gulf which separates these two methods of learning is not very wide in fact. Both types represent the same technic of repetition and assimilation. In the first type however the stimulations come from the nature and condition of the organism itself, and its inherent tendency to discharge its native reactions, while in type B the stimulations come from the environment. The first type is therefore an adaptation to the nature of the animal so to speak, while the second type lays behavior out adaptively to the environment.

In neither of these two primal modes of learning is repetition itself necessarily meaningful, nor are trial and success as such. The working out however of a simple mode of behavior on the basis of the stamped-in effects of repeated stimuli, and a rough working of the law of averages among repeated opposite stimuli, is the illuminating phenomenon, whether the stimulation comes from the organism or the environment. This is a fact of signal importance to learning. It does not seem too much to say that this general technic, found at the base of learning, lays down the mosaic background upon which the structure of the learned behavior of animals is laid out in figure.

Type C. Organic Choice (Adaptation to Functional Meaning)

The next step in learning which seems to possess definitive clearness is the shortening all at once of a serial reaction, learned perhaps as in type B, by the elimination of some or all of the middle terms and passing more directly from the initial to the final term of the reaction. Let us illustrate this mode of learning by epitomizing an account of the behavior of a stentor as given by Jennings. Carmin is added to water in which a stentor has been placed. The following change of behavior is noted. The animal first turns to the aboral side to avoid stimulation. This may be repeated. Ciliary currents are suddenly reversed if the stimulation persists. This also may be repeated. The animal then contracts. After this is repeated and accentuated, the animal abandons its tube and swims away. This full reaction is given because of values it has for the discussion later. For the matter now in hand let us suppose that the stentor gets relief from the stimulation of the carmin by contracting into the tube. At length it comes out and the water currents of the ciliary motion again strike the disk. Suppose carmin comes again, what is the usual reaction? Let us quote Jennings:

"The stimulus and all the external conditions are the same as they were at the beginning. Will the stentor behave as it did at the beginning? Will it at first, not react, then bend to one side, then reverse the current, then contract, passing anew through the whole series of reactions? Or shall we find that it has become changed by the experiences it has passed through, so that it will now contract again into its tube as soon as stimulated? We find the latter to be the case. As soon as the carmin again reaches its disk, it at once contracts again."[1]

This third method of learning is expressed by Jennings in the simple formula, reaction *ABCD* becomes reaction *AD*.[2] He believes that the middle terms *B* and *C* are not wholly eliminated, but are run off so rapidly as not to appear in observed behavior. However for our purposes we may say that the response which has proven most useful to the animal, in time, entirely overcomes all responses of lesser meaning. Let us call this learning *the repetition and shortening of a serial reaction.*

It should be noted at once that we have here the same background of repetition and assimilation; but the latter is no longer operation with reference to the loci of the points of stimulation, but with reference to the relative intensity or meaning of the stimuli and responses. This learning looks like association and comparison but it is better to avoid words of intellectual connotation. Jennings says it is due to the law of the 'ready resolution of physiological states.' This description has the merit of calling our attention to the interaction of the organism itself, but it takes the matter out of the field of scientific objectivity for the present as effectively as does description in the most intellectual terms. This learning seems to be adequately described if we say that the relative intensity or meaning of stimuli and response is stamped in by repetition and that organic assimilation, everywhere at work in the background of learning, selects out the final learned reaction.

The description above attempts to assess this third type

[1] 'Behavior of Lower Organisms,' p. 175; see also pp. 287–292.

[2] P. 290. Thorndike also brings this behavior out in on experiments chicks, dogs and cats.

of learning as a form of reaction to the environment. Let us look at the possible effect of the process involved in this learning upon the organization of the reaction system of the animal. Suppose we express the complete serial reaction of the stentor as given above in terms of an *ABCDE* serial reaction. Let us now suppose that the *B* response is eliminated from usual behavior and that *ACDE* is the total reaction for the time. Finally *C* is dropped and in due time *D* also. *AE* now becomes the usual adaptive response by the process of elimination we have described above. No one of course would assume that elimination will happen in just this way always, but the assumption in the form we have made it will illustrate the point we are urging.

Now presumably in the experience of the animal conditions may arise in the future which may call up anyone of the previous reaction series, or even bring it about that one after another shall become the most usual response in ordinary adaptation. All that is demanded for this to take place in some manner or other is a changing environment; for the neural organization already has potentially present any one of the following reactions, *ABCDE*, *ACDE*, *ADE*, *AE*, and in addition, because of the nature of the process of associative assimilation, the incipient beginnings at least of *ABDE*, *ABCE*, etc.

Now by the process of ordinary selection in any given environment, some of these potential reactions would be overlaid and lost, while others would be stamped in by use,—some more, some less—in the ordinary round of stimulation, response and adaptation. The repeating of whatever reactions the organism retained and the assimilation of these stamped-in effects, would give to these reactions an internal organization and relation among themselves. Such an organization as would in this manner be built up in the centers would appear to be just the sort of organization we are forced to posit behind the well-known graduated repertoire of reactions which many animals release under stimulation, and which is very well illustrated by the serial reactions of the stentor as given by Jennings. If this be correct, this third type of learning is especially responsible for the repertoire reactions which many animals display.

This type of learning which involves the elimination of some of the middle terms of a series also appears to explain the real nature of the difference which exists between the kinds of association. Once the simplest form of association —association by contiguity—has been reached in the learning process, this lower form seems to become association by contrast or similarity by means of this simple technic of type C. From a series of terms strung together by association by contiguity, we get the higher forms of association by the slipping out of those terms which have little selective value to the particular mental 'set' or purposive attention which the mind may at the moment happen to have. This matter is too involved to go into here. Professor James's discussion of associational processes[1] will be found, I believe, to connect well with this view, and furnish strong evidence that Jennings's 'law of the ready resolution of physiological states' forms the organic background for the differences which obtain between association by continuity and higher association.

Type C also furnishes the organic basis for comparison and choice of the definitely conscious sort. While it is doubtless true as James asserts that the reflective attitude becomes the habitual adult attitude, it is likewise true that we greatly overestimate the importance of the reflective function in ordinary routine matters. Reflection itself is for most persons in most activities probably at a minimum, but a telic attitude laid down by reflection sits in judgment over much of our behavior. The unconscious method of comparison which we have noted in this type of learning always gets in on the ground floor and continues to be very important in human behavior, and much that we think of as reflective choice is only so after the event, when the results of the choice are picked up by the smooth delicate technic of intellectual reflection. Some of our choices are of course highly reflective. Some persons make many of their choices

[1] 'Psychology,' Vol. I., ch. 14.

this way. Probably most of our choices however have only a small modicum of reflection in them, beyond which they rest back on the results of this unconscious process of organic comparison.

III. Higher Animal Learning

Types of learning A, B and C appear as we have seen in lower forms of animal life; for they require nothing beyond direct sense stimuli and resultant feeling. Organisms which do not possess the senses of sight and smell seem to be limited in their learning to these three types. Learned behavior beyond these probably has to await the cephalization of receptors with the attendant differentiation of the senses. These senses extend the capacity of types of learning already present and add new types. The importance of the eye in learning is well known. The sense of smell also comes early into play and is thought to fulfil an important function in adaptation. The senses of hearing and taste, while very important, are not especially unique in method.

Type D. Organic Association (Association by Contiguity)

The technic of learning by odor appears to be very simple but it is structurally different from the types we have considered. An animal which by repetition of stimulation comes to know the odor of persons, companions, or certain food, connects the odors with the objects respectively, or as we would say associates the two so that the odor quickens and guides the search reactions. Many animals appear to have very acute sense of smell and remarkable powers of differentiation, and this sense is conceded to be very important in learning. With respect to this sense the insecta are especially remarkable. The quickness of the dog and many other animals to learn by odor is well known.

The structure of learning by odor seems to be all of this associational type, as is also the simpler learning through the eye. Learning by sound and taste is no doubt of narrower range but is probably all of this type. The structure of this mode of learning is distinguished from the associative comparison of type C in this, that the connection in type C is in the direction of a motor serial reaction which has been learned, and consists in merely shortening this series; whereas in the type under discussion the odor for example becomes connected with the food, which means that *a cross connection, so to speak, has been made and a new term of adaptive value added.*

Lubbock's experiments with ants seems to prove clearly that they find their way to food or back to the nest by following the trail of companions by means of their sense of smell. Lubbock found that when an ant returned to the nest with food and then made the return trip to the food, other ants followed. By using a movable path Lubbock showed that these ants did not follow the other ant but followed its trail on the path. It is also thought that bees come to the honey in the flowers by associations of odor and color. This general field is controversial however. The local action defenders have their views, and it is not clear also just how much of this wonderful behavior of insecta is due to inheritance.

Romanes has given results of experiments with a favorite setter which are clearer. Romanes used twelve men in the trial. It was first found that, besides his master, the dog would follow only one of these, the gamekeeper, and then always as a second choice. Romanes set out followed by the twelve men, the gamekeeper in the rear, and each man taking care to step in the footprints of Romanes. After some distance had been covered Romanes turned to the right followed by five men, while the other seven kept to the left. The dog was put on the trail and without hesitation took the right trail when she came to the divergence.

Associative learning by sight is even clearer. Morgan cites an interesting instance in the behavior of a moorhen which we shall quote. "A moorhen chick, for whose benefit we had dug up worms with a spade, and which, standing by, jumped on the first-turned sod and seized every wriggling speck which caught his keen eye, would soon run from some distance to me as soon as I took hold of the spade." Whatever degree of intelligence we attribute to this chick and whatever may be the points of connection in learning, the instance shows some form of associative learning.

It is of course not assumed that in this learning there is any analysis on the part of the animal, nor is there association in our full sense of the term. There is connection with adaptive action. Association begins, as James points out, in association by contiguity, and this type of learning marks its beginning. Perhaps it is limited in animals to this beginning. At any rate we should assume with great caution that there is in animals any recognition of similarities or contrasts. Of course there is more refined associational connection as experience proceeds, but there is no need to assume that the technic of association is altered. It seems to me that the simple connections of which animals below man are capable merely release the learned reaction with which it is connected. The reaction situation whether it is gross or fine is always, in other words, a total situation. There is no analysis except the organic analysis of the assimilative process. The animal either acts or is confused in the presence of a situation.

Type E. The Organic Conception

Apart from vision animals would seem to be limited to the learning types we have considered. Retinal response however introduces new elements into learning. Other kinds of stimuli come in succession, but the fact of simultaneousness in retinal stimulation and response adds to the fact of succession of stimuli a side-by-sideness of stimuli. On this account there appears with vision learning which looks like association between concretes, and which Hobhouse believes to be such if I understand him. At this stage of learning an animal may *respond to a new situation in a manner which shows the contribution of past experience with similar concretes and yet so as to indicate that it is not wholly determined by such experience.* For example, a dog by experience with this, that or the other house comes to be more adept in accommodating his behavior to any particular house.

Hobhouse tested a fox-terrier by taking her in a box to the second floor of a strange house. The dog's master called her from without and the dog saw him from the window. After some hesitation the dog 'soon started off, and went steadily out of the door, downstairs, out of the house door, and round the corner to her master.' Again, "a dog is held at the back of the house, and sees his master go in through the back door and reappear at the dining-room window, which looks in that direction. After trying to follow his master through the back—unsuccessfully because the door is shut—he makes off round two corners to the front door, and so into the dining-room. He had never been in this room before but has once been from the back into the house by the front door." Once more, "A little fox terrier had once found her way from the back of the house through the front door into the dining-room to her master. I then took her out again, the master remaining where he was, to the same place outside, closing the front door behind me. After trying the front door several times, she at last set off round a further corner of the house, and found the side door, through which she got into the house and found her master." Hobhouse believes these dogs found their way by 'familiarity with houses, staircases, rooms and doors' and by the apparent use of what in humans we call common-sense. Let us attempt to analyze this learning.

To characterize the type of learning which we have described above in type E as association between concretes seems to me to go too far for the facts in one direction and not far enough in another. It would perhaps be hypercritical to find fault in this connection with the expression 'association between concretes' as at least a helpful part description of this behavior, provided only we make the clear reservation that animals probably never do more than attend to the high points in a stimulation situation. Situations seem to be to them always gross situations, and surely stop short of analyzed concretes. With this reservation we may let the expression stand as in part correct, and very convenient verbally.

But there seems to be more than attention to and association between concretes in this behavior as Hobhouse describes it. Mr. Hobhouse seems to think so; for he finds a place in this learning for 'practical ideas' and 'class inference,' and I take it that some such hypothesis is by him judged to be the best way to account for the elements in this behavior which are not adequately explained by a 'knowledge of concretes.' The behavior of the house-broken dog goes beyond mere habituation. There is some evident freedom in it. Something beyond association between concretes is surely demanded by the fact that an animal's skill in adapting his actions to any house grows *pari passu* with his experiences with houses. It is at any rate not clear in what way a one-to-one association between the high points of experience could effect this result.

But Hobhouse's notion of practical ideas is unsatisfactory. Proof is lacking that any animal below man makes use of ideas, as the term idea is employed in ordinary usage. Of course they appear to do so. No one however has seriously urged that any animal below man ever analyzes out similarities or identities on the basis of either order, quality or relation, and the progress of research makes it ever less likely that such a claim can be made. This fact does away with the notion of 'idea' and 'class inference' if we are to be cautious in our terms. No doubt the word idea might be used in the sense in which Hobhouse uses it and the difference of opinion be reduced to a matter of definition. Evidently the word 'practical' in the phrase 'practical ideas' is intended to do this. But it does not wholly prevent a vicious stretching of terms. Besides the word idea is not just the one the facts demand as we shall see.

Let us look more particularly into this mode of learning as seen in the examples of the dog fitting his behavior to the house. First of all it is clear that there must be some knowledge of and association between concretes (the high points of experience). In the second house of a dog's experience this must be so. It is not clear that there could be less and be any learning of the sort we are considering and there could obviously not be more than a one-to-one association in second house of experience. Since we are not admitting any knowledge of isolated-out concretes however, this association of the second-house stage would not be structurally different from type D. Any difference between this learning and that cited in type D, is a difference in degree and not in structure.

But in the example of the dog, as experiences with more houses come, adaptation increases. The matter looked to Hobhouse like 'class inference' and it is this for which the one-to-one association seems inadequate. It is not the smoothness of the adaptation alone which shocks our credulity; for it is a well-known fact that associations may come with kinetoscopic rapidity. But any selective law is wanting by which any one-to-one relation between concretes would bring at each point of the present problem just that association from just that particular house of the houses of experience, which would best adapt to the present problem. Now if such a one-to-one association were nevertheless conceived of as the basis of this learning, then the freedom of the learning is only apparent. The behavior would in this case be made up of many fixed reactions pieced together, so that while the whole is not made on a set plan, the parts are. But if this be the case we have in turn no new learning structure that is unique, but a rapid exemplification of the type described under type D. Indeed, if we are to go so far in the name of a one-to-one connection it were better to go further, and declare, unless prevented by some good reason, that there is no association whatever but a mere kinetascopic releasing of reactions due to stimuli which to the animal were identities. The sight of the high points merely released learned reactions.

But such a view is not satisfactory. It taxes our credulity. It is not only difficult to see how wider experience could increase adaptation, except within modest limits, upon the basis of mere association; but it is also difficult to see what would prevent such increasing experience from resulting in confusion which would paralyze action. What advantage can come from multiplying learned associations where there is no selecting or generalizing principle at work? It is in this situation before the facts that we feel the need of something comparable to Hobhouse's 'practical ideas' and 'class inference' to account for the nature and increase of adaptation.

That which appears to be needed to clear up this phase of the problem is appeal once again to the assimilative process which we have been able to discover at work in simpler lower learning. Let us now look at this type of adaptation with the facts of this appeal to organic synthesis in mind. In doing so it is of course agreed that the dog's adaptation to the second house of experience, in so far as it is learned at all, is by means of a one-to-one association. The problem to be further discussed lies beyond this in the smoother adaptation which a dog achieves through experience with houses.

Now experience with houses would in the first place, by the ordinary effects of repetition, stamp in the various 'high points' of attention which remain constant in the several houses of experience. Differences among the concretes of these houses would receive no such inforcement and the effects of such concretes would fade out. This process working in progressive experience would stamp in the points that are repeated—those that are always present, usually present, often present and sometimes present—so that the total effect when gathered up by the synthesizing process of assimilation, would constitute not the stamped-in effects of experience with this house or that, but a complex of a generalized house, integrated from the several houses of experience. In other words the results of the stamping-in process, carried on and corrected to the needs of action, would be to stamp in the neural centers a generalized motor response or repertoire of responses to a generalized house. In other words, the stamping-in of effects and assimilation of these working upon progressing experience selects out a schematic organization in the nervous centers which gives to motor behavior not a fixed but a generalized and so to speak graduated adaptation.

It will perhaps help us get this view objectified if we conceive of this stamping-in of effects and the integration of these by the assimilating process, if we illustrate the process under the figure of successive pale ink imprints of many somewhat different forms, which however have a generalized similarity and are stamped upon a common center. The resulting composite imprint would have the following characteristics. The center would be very dark and in general the imprint would grow brighter as you approach the margin. The dark parts would extend from the center according to the generalized form of the several dies. Just beyond the dark center would be a middle area, which, while it did not receive all the imprints, received at various areas from many to few imprints according as the various imprints touched these respective areas. The periphery would be pale to very pale having received say three or two or even only one impression according to the projections of the dies and their overlapping margins.

If now we make a hasty comparison between the learning of type E and this composite imprint we have the following suggestions. The darker center of the composite imprint corresponds with that neural structure which has been laid by off-repeated experience and which therefore controls the more fixed elements in the motor adaptation. This part at the very center is no more than stamped-in effects. The next area in the imprint shades from dark to light, according as its parts received many or few impressions from the dies. The neural area which corresponds has also been differentiated by the stamped-in effects of different experiences, which nevertheless have points of similarity among themselves, and this mottled structure carries a rich repertoire of potential reaction, which is drawn upon as needed, by the stimulations of the present experience. The extreme outer margin represents especially the growing part of the complex where new one-to-one connections are made and where structure capable of no more than this, becomes by reinforced experience more generalized structure like that mentioned above.

The learning then of this type is complex. It depends upon a complex neural structure which offers to adaptive behavior a certain general fixity built up by the constants of a class of similars of past experience; a field of rich repertoire and free adaptation laid down by the relations of similarity and difference in this class of similars; and structure adapted to one-to-one association in which this type of behavior has its beginnings. The confusion and the lack of uniformity in the animals running off of this type of behavior, which has been remarked by Hobhouse and others, is due to the nature of this complex structure. Any single instance of this type of behavior may however draw upon all of these parts and yet be smooth adaptation.

This neural complex which we have endeavored to describe is the organic background of the concept and it may be wise to turn from the schematic description above and consider this learning with reference to the functional use of the concept. The intellectual concept is formed largely by elimination. It is what is left after a class of similar concretes have been generalized. For this reason a concept lacks in definitive clearness in the strictest sense. Anything we may say about any concept is more or less true. We can for example hardly define the concept house. Some parts of a house are present in all houses but all minor parts are subject to variation in size, shape, and position. Other parts are usually there, some often and some seldom present. In short a concept is not in primary structure an intellectual thing, and therefore is not subject entirely to definition. It is in its genesis organic and its structure is suited only to adaptive use.

The concept comes from integrating on the basis of the law of averages of a class of similars. It is often a mere name or sign of this generalized whole. Its real meaning however centers in the relative constant elements in the class, together with the umbrage of less constant values surrounding these. The outer margin is negligible in abstract usage, but possibilities of associative connection lie hidden here, which may be called out in the presence of any particular concrete of this class. The concept grows by recognizing new similarities in the class, and this happens only when experience with the concretes of the class widens. Now it would obviously be quite impossible for us to handle in thought any great number of concretes and manage them at all well, if it were not for this technic of gathering them into classes by the concept. Only by this means do we adapt our thoughts to concretes in a smooth and discursive manner.

In the learning of animals we are not dealing with thought adaptation but with motor adaptation. But the thought adaptations have come from the motor adaptations, and the organic generalizations which the latter achieve have given the ground plan to the process of conscious intellectual generalization. The technic of the intellectual concept has come in other words from the 'organic concept.' The process of organic assimilation working upon the animal's associations between the 'high points of experience' builds up a motor association complex, and this complex furnishes the neural structure by which the animal's behavior among a class of similar concretes becomes discursive in motor behavior. We feel justified therefore in describing the learning of type E as *the use of the organic concept*, and we may assert that man, despite his conceptual powers in the intellectual sense, makes a large use of this organic concept.

Type F. The Organic Judgment

Among the higher animals below man and especially among the other primates there is evident a still more complex expression of learned behavior. *This behavior manifests association between complexes—between relations. The adaptation shows a rather nice accommodation to the general problems of the environment.* Mr. Hobhouse believes that learning of this type displays some use of the practical judgment. By this he means that there is a correlation between a 'practical idea and a remoter end.' Upon this point he is cautious, I think, but believes that the nature of the adaptations which apes make requires this view and for some of the adaptations of other animals it is the best working hypothesis for the present.

The best examples of this type of learning are found when animals are adapting themselves to humans or other animals, for situations here are sure to be more or less dynamic and hard to meet by habit learning. Hobhouse limits the higher expression of this type to primates which he says use 'articulate ideas' and make an inferential 'application of experience.' We are not able to see that any animal behavior goes beyond the general descriptions of this type F which is shared in different degrees by all higher animals. We shall say a word presently about Hobhouse's 'articulate ideas' and 'application of experience.' Let us first give concrete example of this type of learning.

"One of two dogs, the larger, had a bone, and when he had left it, the smaller dog went to take it, the larger one growled and the smaller one retired to a corner. Shortly afterwards the larger dog went out; but the other did not appear to notice this, and at any rate did not move. A few minutes later the large dog was heard to bark out of doors; the little dog then, without a moment's hesitation, went straight to the bone and took it."[1]

This behavior indicates a connection between the learned relations, 'bone at such a place is wanted,' and 'Big dog out-of-doors is at a safe distance.' If we were to put these into intelligent human thought for the little dog they would be shaped somewhat as follows: "I want that bone from which the big dog drove me, and now that he is safely out-of-doors I may go and take it." There is no need however to assume upon the part of the little dog any appreciation of all this. We may substitute for this intelligent interpretation of thought and telic aims, the stamped-in effects of past experience and functional ends. This is the interpretation which we are giving.

This behavior shows association between complexes or relations but it requires more than this for its explanation. Also just as we stressed above the wisdom of using the word idea in accounting for that in type E which association between concretes did not cover, so now, for the same general reasons we must disapprove of the word 'judgment' to account for that for which connection between complexes has

[1] Hobhouse, 'The Evolution of Mind,' p. 264, as quoted from Morgan's 'Comparative Psychology,' p. 300.

too short a reach. Nevertheless something comparable to 'judgment' is needed to account for this adaptation.

Let us see. We have discussed above the process by which a complex is built up about experience, with a similar class of concretes, by means of which simple complex the animal makes motor adaptations to any member of this class of a discursive sort. This was effected by repeated association between the concretes and assimilation of effects. This learning which we are now analyzing goes a step further in the same direction. It begins not in association between concretes but in association between relations or complexes. As the connections are repeatedly made between the members of a class of similar relations in experience, synthetic assimilation is at work on the effects, as ever, and by means of both of these, association and assimilation, a larger and looser complex is shaped which is the background of this behavior and the organic basis of the judgment. We shall call this type *learning by means of the 'organic judgment.'*

This of course differs widely from an intellectual judgment, however 'practical' such a judgment may be, for it is merely a motor adaptation, a projection of an entirely unconscious sort of the effects of generalized experience into behavior. When man knows "he knows that he knows." His adaptive processes have become conscious and thereby his powers have been infinitely enlarged. It should be noted however that the intellectual judgment gets its structural type from the organic base of this learning of type F.

A judgment is a generalized expression of relation. It is a generalized form ready to be supplied with one of a class of contents, according to the present selective function of thought, and it is this structure of the judgment which gives to human thought its discursive nature. Likewise this type of animal learning is a generalization among the relations of motor experience, in which a class of relations are so generalized in the neural tissue, that any one of the class of relations may be fitted to it as a content and so adaptation among the class become discursive.

Such discursive behavior is especially called out by animal play, or by an animal's adaptation to men, such as a dog's behavior to his master; or by complex problems of the hunting type. Of course in this higher learning lower types are usually also at work, but it is this highest form of animal learning which makes some of the behavior of animals in a variable environment look so convincingly like the use of prevision.

As stated above Mr. Hobhouse believes that animals also learn by 'articulate ideas' and by 'a spontaneous application of experience.' Let us consider these two modes of learning to see if they may not be included within the structural types we have already considered.

By 'articulate ideas' Hobhouse means, it seems, ideas which have a decisive concrete clearness. A dog may learn to push a bolt to one side. This requires a 'practical idea' only. A primate may learn also to push a bolt 'until it clears a staple,' which requires an 'articulate idea.'

This looks like a new type. Without doubt it goes beyond behavior we have described. It is not however in my opinion based upon new structure, but rather represents the integration of type E with type C. In other words type E is perfected to a point where type C functions within it. The 'organic concept' in the learning of a dog or cat may always remain too gross for this to take place. The monkey however with larger exploring tendencies and more refined attention registers successes attained when the bolt is pushed by the staple, and in due time drops all unprofitable movements, retaining only this successful reaction. The shortening of the learned reaction is what leaves this behavior so striking.

Again, learning by 'a spontaneous application of experience' is distinguished from habit and associational modes of learning in a decisive manner. It is not merely based upon experience. It is in the form of a hypothetical inference from experience. This novel reaction to the environment, Hobhouse believes to be limited to primates.

I have however observed this type of behavior in more than one farm dog which had become a practiced groundhog hunter. Whenever one of these dogs came into the vicinity of a woodchuck hole, he would strike a hunting 'set' and after advancing a few steps slyly, make directly for the hole at full speed. This he did even if the 'chuck' had been espied at some distance to the right or left. This surely looks like prevision. The dog seems to say, "If I can get between the hole and the 'chuck,' I have him."

It seems to me however that we have here no more than organic learning. Let us see! Suppose we consider this type of learning as type C functioning within type F, what can we make of it? This seems to me the most likely interpretation.

It should be noted that all previous experience of these dogs with groundhogs had centered about their holes. The pursuit had time and again ended here. Arriving just too late on many occasions has made the hole the hot center of this experience. Besides if chucks were caught in the past it was usually just as they were about to dart into the hole. No matter where the chase began, what its direction or fortune, it ended at the hole. The hole therefore becomes the controlling point—both the constant in the complex and the point of highest meaning—and all other behavior is in due time eliminated in favor of 'making direct for the hole.' This behavior is then due to the 'organic judgment' perfected by the 'resolution of physiological states.' That is, it is the integration of types F and C.

The 'organic judgment' unquestionably fills a big place in human adaptation also, especially motor adaptation. Anyone who has watched the process by which he gains in skill in playing a competitive game, must have been impressed by the distinction between the function of the 'organic judgment' and the reflective judgment. One does not learn to play a game of skill by reflection but by practice. The learning must be stamped in by action and generalized, and no amount of discriminating thinking about the game will compensate for failure to practice it. The reflective process merely sits monitor over this more fundamental organic process to remove hindrances. To see how an act ought to be performed, therefore, and to have the motor judgment to do it are far from equal accomplishments.

But the technic of the organic judgment is not limited to motor adaptation. It is the ground plan which remains the norm of safe thinking. The intellectual judgment is winged, and it is therefore quicker. It often takes the short road. It is especially useful in meeting new situations or in adapting to a dynamic environment. Elsewhere the organic judgment is surer, if slower, and all thinking at last has to be corrected to it. The intellect provides a sort of 'first aid' adaptation which ripened experience supplements. The common sense of mankind has registered this truth in the value it has always laid upon the reliability of 'learning by experience.' Not only so but in the highest intellectual achievement it is not safe to get too far afield from this method of learning. In fact it may well be urged that the inductive method is as safe and as fruitful as it is, because the more rigorously it is followed, the nearer the technic of the process approaches that of the organic judgment.

Summary

I. Lower animal learning
   1. Organic fixation
   2. Organic spacial adaptation
   3. Organic choice

II. Higher animal learning
   1. Organic association
   2. Organic conception
   3. Organic judgment

Lower types of learning function also with the higher on the upper levels of animal learning and account for some of the unusual learning which appears convincingly intellectual at first. This is shown in learning by what Mr. Hobhouse calls 'articulate ideas' and 'inference from experience.' All learning however seems to accommodate itself to explanation under one of these types or the integration of these types.

Throughout the entire field of learning covered by these six types, there are found three constants:

(*a*) Repetition of stimuli and response
(*b*) Synthetic assimilation of effects
(*c*) Projection of integrated result of (*a*) and (*b*) in behavior.
These three represent therefore very inclusive generalizations upon the learning process. The first two (*a*) and (*b*), which represent the process which lays down the structure of learned behavior, show a striking similarity to Osborn's 'action, reaction, and interaction,' which he asserts represent major generalizations upon the process which lays structure in organic evolution.

A POET'S PORTRAYAL OF EMOTION

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To the scientist, human emotion is a realm for study; to the artist, it is a field of operations: meanwhile each is somewhat hampered by an incomplete understanding of the other. The illustrations whereby psychologists illumine their deductions are marked by a certain lack of scope and distinctiveness. The pictures skilfully drawn by poets and novelists sometimes fail to convey their full meaning because that meaning was less clear in the painter's mind than was the dramatic value of the scene.

It is not to be supposed, of course, that a mutual encroachment on each other's territory would be profitable. There is one glory of science and another glory of art, and neither is to be enhanced by borrowing a halo from the other. But an excursion by each side into the preserves of its neighbor merely for the sake of seeing a large object from a different point of view could not be otherwise than doubly advantageous.

It happens fortunately that a philosophically inclined poet has staked out his claim, and with an ample circumference, on the borderland of the two empires, so that he is easily accessible from either approach. Robert Browning has by no means a monopoly on the recording of emotion, but in range, variety, and complexity of the record, supplemented by a crystallized perception of its significance, he has no rival. Moreover, he has realized the psychologist's own problem. In his 'Charles Avison,' one of the 'Parleyings,' he says:

> Now could we shoot
> Liquidity into a mould,—some way
> Arrest Soul's evanescent moods, ...

and adds,

> To match and mate
> Feeling with knowledge,—make as manifest,
> Soul's work as Mind's work, turbulence as rest,
> Hates, loves, joys, woes, hopes, fears, that rise and sink
> Ceaselessly, passion's transient flit and wink, . . .
> . . . to strike all this life dead,
> Run mercury into a mould like lead,
> And henceforth have the plain result to show—
> How we Feel, hard and fast as what we Know—
> This were the prize and is the puzzle!

In a letter to Ruskin he states his conviction that 'all poetry is the problem of putting the infinite into the finite.' And in 'Two in the Campagna' he acknowledges the difficulty of doing it:

> Only I discern
> Infinite passion, and the pain
> Of finite hearts that yearn.

But in spite of its baffling elusiveness, emotion is the element in human life and character that Browning most delighted to honor. Added to his natural instincts as an artist were those qualities of his own temperament that encouraged his zeal and sharpened his understanding in this matter,—his fondness for subtle and poignant reactions, for the crests and crises of existence, for color, noise, and the thrill of motion, for conflict and its decisive terminus, for aspiration, accomplishment, defiance, his zest in waking people up, his catholic taste in disposition and situation. It is because of these very things that he 'writes with fury, but does not correct with phlegm,' as one of his critics complains, that he 'writes like a lion devouring an antelope,' as another puts it, and that he made still another feel as if he 'had been taking a bath among electric eels.'

In order to give point and definiteness to this analysis of Browning's treatment of emotion, I have selected some typical examples to be considered from two angles; first, the 'tensional' explanation of this experience, and second, its ethical aspect.

To the psychologist an emotion is an alert, heightened, but evanescent state of consciousness, involving some clash between conflicting stimuli. The possession of 'mingled emotions' is therefore not an occasional phenomenon but the inevitable thing. Envy would not be envy without its sting of shame. As soon as a joy ceases to be a fearful joy it subsides into a mood of content. Desire takes its edge from anxiety. Grief is kept alive by the refusal to accept disappointment or bereavement as complete and final; such acceptance induces sodden resignation or sullen despair, unless the sorrow is transmuted into cheerfulness through a new channel of hope, or the anodyne of activity.

Conflict, however, means the dominance of one constituent, even if the ascendency is only temporary. The drawn-battle stage cannot last long. An angry man, for instance, is a seething mêlée of scorn, rancor, disgust, jealousy. Presently one of these privates may assume command, and the angry man becomes a disgusted one; or the anger may be changed into remorse or triumph, as the case may be, through the dynamic outlet of striking a blow; or tranquillized into an amused contempt by the intellectual process of thinking it over.

The range of emotion is thus conditioned by consciousness, just as are the sensations of sound and sight. We count only a limited number of hues in the spectrum, not because the color-making apparatus is limited, but because we are. So if we can count only half a dozen or half a score of emotions, it is for a similar reason. Without pushing the metaphor too far, we may reckon as emotions those experiences which fall between the 'ultra-red' instincts, impressions, moods, and the 'ultra-violet' convictions and sentiments. Sometimes consciousness is literally destroyed, as in cases of swooning from excessive joy or fright, and sometimes it is converted into action.

Since some sort of a catalogue is necessary, I have chosen this middle register of the emotions as a basis for examination. My list, suggestive rather than exhaustive, includes the following: disgust, envy, fear, anger, grief, joy, pity, shame, and adoration. The number may be duplicated by recognizing the intensification of each one as a different emotion.

Thus disgust raised to the *n*th power becomes loathing; envy, a consuming jealousy; fear, horrified terror; anger, fury; grief, anguish; joy, ecstatic rapture; pity, poignant compassion; shame, humiliation; and adoration, worship. Four of our deepest and most universal feelings are omitted, being accounted as more permanent, stabilized sentiments. These are love, hate, pride, and hope. The real emotional opposite of shame is not pride, but a joyful exultation, and the direct contrast of fear is not hope, but a joyful relief. Curiosity, amazement, and amusement are intellectual reactions, tinged with emotion. None of these has escaped Browning's observation and portrayal.

Disgust

The soliloquizing monk in 'The Spanish Cloister' and the duke in 'My Last Duchess' are commonly thought of as incarnations of hate and cruelty, and indeed they both confess to cherishing those amiable qualities. The pious votary says in so many words,

> If hate killed men, Brother Lawrence,
> God's blood, would not mine kill you!

But in his case this chronic attitude was heated to the temperature of disgust by the intrusion of the despised though unconscious offender into his mood of lazy, smug satisfaction. The very sight of his pet aversion, tedious old fool that he was, pottering about in his garden was enough to raise the simmering spite of the onlooker to the boiling point, and cause his malicious, sarcastic envy, brewed by the ingrowing life of idleness and forced monotonous companionship, to froth over in a seething, unsavory loathing whose mumbled tirade would have scalded his 'heart's abhorrence,' had he been within reach. Withal, the necessity of dutiful response to the calls of religion adds the completing foil:

> 'St, there's Vespers! *Plena gratiâ,*
> *Ave, Virgo!* Gr-r-r- you swine!

The aristocratic, self-contained Duke of Ferrara, addressing with polished vivacity his guest, the envoy sent to arrange the terms of marriage to the next duchess, would seem to have nothing in common with the vulgar, unrestrained monk. Yet his dominant emotion—disgust—is the same, and is given a different complexion by differences in source, constituents, and outcome. In him the consistent mood of scornful pride is keyed up into a reminiscent disgust by the situation, and that in turn is tempered by his artistic preoccupations and his consciousness of connoisseurship in oils and bronze. He had once felt strongly enough to do what the monk wished vainly he might do, yet he did it with true patrician imperturbability. So now there is no effervescence in his emotion, partly because of its retrospective nature and partly because of a disposition that plumed itself on its haughty self-control. He is therefore able to diagnose his own case accurately:

> Merely to say . . . Just this
> Or that in you disgusts me; here you miss
> Or there exceed the mark, . . .
> E'en there would be some stooping; and I choose
> Never to stoop.

It is the duke's fastidious contempt for carelessness, in contrast to the monk's careless contempt for fastidiousness, that allows his sneer to preserve its placid surface, and his vengeance to operate with a dispassionate inhuman effectiveness.

Envy

Four of Browning's characters are actuated by envy. They all seem as poised and passive as the duke, yet three are like him driven to murder, and the fourth is obsessed by it in his last hour on earth.

The dainty Parisian dancer (in 'The Laboratory') who purchases poison with a kiss, and chats with the chemist while he fills the order, is as good an example as Medea of the diabolic fury of injured pride. Never are human passions so deadly in their warfare as when love is turning to hate. In this case the mood of hate was stimulated to an implacable jealousy by the vision of faithless lover and rival at the king's ball, but since it was finding an outlet in decisive action, it could pretend to play. The little lady spices her rage with an interest in criminal chemistry and sweetens it with mocking laughter, though these really fan rather than smother the flame of her revenge.

The lover of Porphyria and the husband in 'A Forgiveness' are also casual in deeds of horror but the fatal decision was in both instances preceded by a period of conflict. Into the lover's mood of hopeless longing glides the sweet surprise of Porphyria's presence. Out of the struggle between the supreme bliss of the moment and the unendurable agony at the thought of its brevity comes the feeling of spiritual jealousy, as it were, and this leads to a way of capturing and keeping the fleeting perfection at which it seemed even God could not say a word.

The mood of the husband is a brooding suspicion that finally rankled itself into an overwhelming jealousy. When his destroyed faith had gathered enough force from repression and had conquered love and prudence, he became an Othello, a cool, esthetic, Browningesque sort of Othello.

The Bishop of St. Praxed (in 'The Bishop Orders his Tomb') is another connoisseur in art and as proud as Ferrara of his exquisite taste, but his pride is pricked into anxiety by the approach of death. Apparently the non-committal attitude of his 'nephews' toward his eager desire for a better tomb than old Gandolph's frets this anxiety, wavering between assurance and distrust, into a greedy envy that is soothed at the end into a gloating triumph, like the Duke's disgust, none the less keen for being aroused from remembrance of the past.

Fear

Of all our emotions this is perhaps the most poignant and the most delicately poised. Our instinct to pit hope against it is acknowledged by the poet in his

> Beat out thy last voluptuous beat
> Of hope and fear, my heart!

And again an immediate sequence is indicated in the exclamation,

> No fear! Or if a fear be born
> This minute, it dies out in scorn.

The effect of conflict is expressed by the Threatening Tyrant ('Instans Tyrannus') when he admits that "The small turns great if it vexes you." Thus was his mood of annoyance intensified to exasperation by being baffled and frustrated, and this in turn to fear—"So, *I* was afraid"—by a new and unexpected sort of opposition. His account, however, is almost too detached to be called an emotion. The three most conspicuous examples of real fear are Caliban; the wife of Dmitri, in 'Ivan Ivanovitch'; and Count Guido Franceschini, villain of 'The Ring and the Book.'

Caliban, dabbling his feet in the cool slush of the cave and gazing out at sea and sky, indulging himself in theological speculations and a dare-devil intellectual analogy, is in a mood of complacent enjoyment. This is shattered and supplanted by fright through the bomb-shell of a sudden storm—to his superstitious soul a sure sign of divine wrath. In a confused welter of remorse, abject submission, trembling hope and potential gratitude, the cowed slave grovels and mutters,

> Fool to gibe at Him!
> Lo! 'Lieth flat and loveth Setebos!
> 'Maketh his teeth meet through his upper lip,
> Will let those quails fly, will not eat this month
> One little mess of whelks, so he may 'scape!

Quite similar is the mixture in the stricken heart of Dmitri's wife as she recounts the tragedy she has just lived through and tries to explain how and why, in a literal sense, she did live through and come home alone. Her experience is the most subtle of all. A simple innocent woman is subjected to the prospect of a terrific physical agony (named by the shrewd and cynical Adversary in *Job* as the severest test possible to make) which may be averted or at least postponed by the sacrifice of her four children to the attacking wolves. As she relates how her growing dread was sharpened into an anguish of despair, she becomes incoherent with grief, terror, apologetic self-justification, and trust in absolution, finally swooning under the strain.

Frenzied incoherence also is the climax of Count Guido's career, as the second of his two long speeches ends in a cry of collapsing consciousness. Totally lacking in pity and a saving sense of shame, his controlling emotions up to the crisis had been envy, anger, and disgust, expressed in acts of deceit and a wanton, gratuitous cruelty. Brought to bay before the tribunal of justice, he simulates pride, hope, righteous indignation, as long as these have any chance of serving his ends. But finally, confronted with immediate, inexorable, and absolute doom, when his last pitiful card of confident incredulity had been played, and trumped by the dread document from the Vatican, he is wholly possessed by the fear that must inevitably triumph in the heart of the coward. His last nervous outpouring is the scream of the trapped animal:

> Sirs, my first true word, all truth and no lie,
> Is—save me notwithstanding! Life is all!
> I was just stark mad—let the madman live
> Pressed by as many chains as you please pile!
> Don't open! Hold me from them! I am yours,
> I am the Grandduke's—no, I am the Pope's!
> Abate,—Cardinal,—Christ,—Maria,—God,—
> Pompilia, will you let them murder me?

After this, even without the guillotine, the rest would be silence.

Anger

Of this emotion 'The Ring and the Book' also furnishes the most notable instance. After the first trial, Caponsacchi settles down at Civita in a mood of dreary resignation, which is fired into a passionate alarm and indignation by the tragic news that summons him back to the witness stand. No longer on the defensive, he turns the tables and assumes the rôle of accuser and judge, fusing his grief, tenderness, and infinite ruth for Pompilia, with his disgust at legal cynicism and its consequent incompetence and unpardonable failure, into a white heat of blasting, ironic scorn. The flame of his fury burns so brightly, sending out its little darts of bitter contempt, that it almost conceals the fuel it feeds on, fagots of compassion, despair, and adoration. It is only when the blaze dies down that we see their charred embers lying in the gray ashes:

> Sirs, I am quiet again. You see, we are
> So very pitiable, she and I,
> Who had conceivably been otherwise.

Of a similar quality out of a totally different source is the anger of Ixion (in the poem of that name) whirling on his wheel. The struggle is between a prolonged physical torture that would welcome the relief of oblivion, and the mental torture that writhes under its sense of injustice and rejoices in its own vitality. He suffers but triumphs over his suffering by hurling at Jove his defiant imprecations and by wresting an ultimate hope from his present agony:

> . . . from the tears and sweat and blood of his torment,
> . . . up let him look and rejoice!
> What is the influence, high o'er Hell, that turns to a rapture
> Pain—and despair's murk mist blends in a rainbow of hope?

Of a very different quality because lowered by personal spite and resentment is the anger of the unappreciated cavalier in 'A Serenade at the Villa.' His fever of self-pity, brought on by the conflict between spurned love and baffled rage, produces a symptom that Ruskin would deplore as a pathetic fallacy:

> How the garden grudged me grass
> Where I stood—the iron gate
> Ground its teeth to let me pass.

Grief

This emotion comes in various textures according as it is woven from loss, bereavement, disaster, frustration of plans, and according as these are personal and selfish concerns or altruistic and compassionate. For an active lamenting grief Browning has little use, having nothing of the Jeremiah in either destiny or disposition. When he portrays regret it is usually in a satiric or at least homiletic vein, as in 'Pictor Ignotus,' 'Youth and Art,' 'The Statue and the Bust,' 'Too Late,' 'Martin Relph.' Even Andrea del Sarto, failure that he was, concluded that he regretted little and would change still less, an unashamed acknowledgment more approved than a weak apology. In dozens of poems we are told that 'it's better being glad than sad,' from 'Prospice,' 'Abt Vogler,' and 'Rabbi Ben Ezra' to the 'Epilogue to Asolando.' Nevertheless, on the other hand, we have the moods of pathos and wistfulness in 'Love among the Ruins,' 'A Toccata of Galuppi's,' 'Two in the Campagna,' and in the unanswered questionings of Cleon and Karshish.

The grief of Caponsacchi is swallowed up in anger, and Pompilia, in spite of her 'great, grave, griefful air,' fights her way through dismay, anguish, bewilderment, and despair, to hope and finally a gratitude—having the least to be gratefor—that absorbs all else.

The souls of Sebald and Ottima, (in 'Pippa Passes') the one swaying between remorse and a guilty acquiescence, the other still 'magnificent in sin,' are quickened to a belated shame and grief by the voice of Pippa, and these emotions are strong enough to effect a self-imposed retribution. The struggle of a base passion fighting its way to a high renunciation is signalized by the lover's cry that he was 'proud to feel such torments.'

Joy

Browning is not unique in preferring joy to grief. Most of us are biased in the same direction. But depicting an emotion is quite a different matter from entertaining it, and it is often the joy of the artist to portray grief. The author of 'Strafford,' 'Luria,' 'The Return of the Druses,' has given sufficient evidence, in these and many another tragic picture, of his ability to understand and express the dust and ashes of life. Yet more perhaps than any other poet has he celebrated its nectar and roses. There are such lyrics of fulfillment as 'Meeting at Night,' 'Now,' 'Prospice.' There is exultation in swift motion and the sense of accomplishment in 'How We Brought the Good News,' and 'Pheidippides.' Even the dubious and dreary achievement of Childe Roland thrills through his horn in a blare of joyful triumph. There is the passionate patriotic fervor of Luigi (in 'Pippa Passes') and the passionate religious fervor of David (in 'Saul'), both winning through anxiety and troubled doubt to a self-absorbing bliss. The passing of an emotion into a mood, as the stream into the sea, is fitly commemorated by Saul's young ministrant as he rides home next morning:

> And the stars of night beat with emotion, and tingled and shot
> Out in fire the strong pain of pent knowledge; but I fainted not,
> For the hand still impelled me at once and supported, suppressed
> All the tumult, and quenched it with quiet, and holy behest,
> Till the rapture was shut in itself, and the earth sank to rest.

Two other examples of a conquering ecstacy are 'In a Balcony,' and 'In a Gondola.' In the first, Norbert's joy triumphs over bewilderment and anger, and Constance's over astonishment and remorse. In the second, the stolen happiness of the lovers is doubly radiant against the sinister background of impending peril and later its actual arrival. All of these confirm by experience Caliban's discovery that joy and grief both 'derive from weakness in some way.' Omnipotence is beyond both, and by the same token, deprived of both. Human impotence is balanced precariously between them and is kept awake by the necessity of preserving the balance. The merry mood, which is the breezy table-land of delight, is a favorite with Browning, and on it are assembled the students in 'Pippa Passes,' the mocking reader in 'Sibrandus,' the Italian Gentleman of Quality ('Up at a Villa'), Fra Lippo, Dominus Hyacinthus ('The Ring and the Book'), and others.

Pity

This emotion is of little interest to the robust herald of success and action, who would much rather admire and congratulate than commiserate and condone. He sometimes enlists a pitiful sympathy on the part of the reader, as for the young lovers in 'A Blot in the 'Scutcheon,' but for him pity is more akin to contempt than to love, and he will not permit us to pity anyone whom he really admires. He will not have us pity Pompilia, for instance, although it is a divine compassion that struggles in her warrior-priest with his suffocating sense of injustice.

The subject is worth a caption, however, for one instance, because in it Browning indicates his belief in its ethical importance. The Persian philosopher in 'Ferishtah's Fancies' shows that pity is a justification of pain and a solution of the whole problem of evil. An example is cited wherein strong feelings of dislike, envy, resentment, are destroyed and then replaced by sorrow over the information that the enemy suffered from ulcer. The conclusion is thrown into the whimsical tone which mitigates much of the poet's didacticism.

> Therefore, Mihrab Shah,
> Tax me my bread and salt twice over, claim
> Laila my daughter for thy sport,—go on!
> Slay my son's self, maintain thy poetry
> Beats mine,--thou meritest a dozen deaths!
> But—ulcer in the stomach,—ah, poor soul,
> Try a fig plaster: may it ease thy pangs!

Shame

Shame is the opposite of pity in being the most inward of our emotions, as that is the most outward. We pity others; we are ashamed of ourselves. To pity ourselves is weak; to be ashamed of others is an unwarranted liberty, and indeed usually has a selfish source. What we are really ashamed of in others is the reflux of their disgrace upon us, and of ourselves in the last analysis for having such disgraceful connections. But the genuine personal humiliation that comes from a conviction of folly or failure is the most unendurable of all emotions, with the least compensation. Those who should be ashamed of themselves but are not are fair game for satire, and Browning does his duty in that direction with notable effectiveness. His subtle treatment of those who are put on the defensive by some challenge and made to retrieve their shame by self-vindication is most conspicuous in 'Bishop Blougram,' 'Prince Hohenstiel-Schwangau,' and 'Mr. Sludge, "the Medium."'

Shame may be compounded with fear, as in the half-sincere fanatic Djabal, (in 'The Return of the Druses'), or with grief and remorse over the injury done to others, as in Martin Relph, Sebald, and Dmitri's wife, or with anger, as in the Queen who took young Norval's declaration of love seriously, only to find it a strategic ruse. This poor lady runs the whole gamut of emotion and is as perfect an instance as any of tension and conflict. No fury of a woman scorned could exceed this of a woman so humiliated, though no scorn or any disrespect was intended.

Adoration

The noblest and most disinterested of our emotions, an element in love, loyalty, and worship, this feeling is diffused through literature as through life, but it is too rare for frequent crystallization. Moreover, expression of it is hampered by its very power. For when Browning himself, the supremely articulate, says, "I cannot praise, I love so much!" he loves with the high humility that adores in silence. Yet his lyrics abound in homage to the beloved, and his narratives in examples of devotion to leaders and causes.

In 'Strafford' we see Cavalier loyalty fighting a losing fight with disillusion, and adoration quenched in submission. The Algerian follower in 'Through the Metidja' has his thrill of worshipful allegiance spiced with a sense of danger. The wounded lad in 'Incident of the French Camp' who brings the message to Napoleon exults, adores, and dies as happy as all of Browning's dying youths. It is like Browning also, lover of animals, author of 'Donald' and 'Tray,' to embody the most perfect adoration in a man's love for his horse. The Arabian in 'Muleykeh' had saved his 'pearl' from the shame of defeat but had thereby lost her forever. She might have been rescued from the thief but at the price of being 'beaten in speed.' He is bereft, desolate, wretched, exultant, proud, for he had parted with his one surpassing treasure rather than abate an inch of her glory. In 'Count Gismond' adoration springs from gratitude; as it does in lighter vein in 'The Last Ride Together,' and of deeper quality in 'The Ring and the Book.'

These are some of the exhibits in Browning's wide picture-gallery. Since his genius was primarily dramatic, his portraits are characterized by individuality and objectivity. There are, however, a few sketches of himself by himself, extending from his first poem to his last, and constituting a testimony to the emotional strain in his own character.

In 'Pauline' he confesses frankly,

> I am made up of an intensest life,
> . . . .
> Which would be all, have, see, know, taste, feel, all—
> This is myself.

At twenty the youth was ambitious to learn mankind,

> Mankind, its cares, hopes, fears, its woes, and joys;

and to attain to joy,

> But one in life, so it were wholly mine,
> One rapture all my soul could fill:

at seventy-seven the young old man waved a gay adieu to life, and made his final utterance, in the 'Epilogue to Asolando,' a voicing of the glad and gallant feeling that had animated always his rich, profound living.

In another early poem ('Sordello'), and the very one that became a byword and jest for unintelligible obscurity, he announced as his poetic creed the simplest and most emotional possible:

> Would you have your songs endure?
> Build on the human heart!

It is in that same 'incomprehensible' story that a character anticipates Fra Lippo Lippi in reading deep disclosures in surrounding faces,—"this stands for hope, that—fear." And it is in another late poem, the Epilogue to 'Pacchiarotto,' that the poet exclaimed with no diminishing of fervor,

> Mine be Man's thoughts, loves, hates!

Nothing is more characteristic of Browning than that his one magnificently sustained flight, 'The Ring and the Book,' should take the unique form of a dramatic monologue sequence, enclosed in parentheses, as it were (the first and last books), of personal revelation; and that these should reveal an emotional attitude toward the work itself, unparalleled in literary biography. The poet is avowedly, and incredibly, passionate over his miraculous discovery, the 'Old Yellow Book,' the 'ingot,' and equally so over the 'ring' he fashioned out of it. He displays to you with pride the repository of

> pure crude fact,
> Secreted from man's life when hearts beat hard,
> And brains, high-blooded, ticked two centuries since,

and adds impulsively,

> Give it me back! The thing's restorative
> I' the touch and sight.

When he turns 'its medicinable leaves,'

> A spirit laughs and leaps through every limb,
> And lights my eye, and lifts me by the hair.

After this we hardly need telling that

> I fused my live soul and that inert stuff,
> Before attempting smithcraft.

Nevertheless, despite these autobiographical glimpses, not forgetting either the tributes to Mrs. Browning in 'One Word More,' 'Prospice,' and 'O Lyric Love,' we do not require the explicit caution in 'House' and 'Shop' to tell us that essentially and deliberately his remained 'the unproffered soul.'

Perhaps it is as a corollary to this objectivity that we find a predilection for the individual as opposed to society or mankind. Browning had an avid interest in all sorts and conditions of men, and women, but few enlisted his affections, and certainly not the whole of them *en masse.* It is truly said, "The voice of a great community wakened no lyric note in him, nor did his anger on its behalf break into dithyrambs." With all his fervent love of music, 'the still sad music of humanity' never reached his ear or heart.

And it is undoubtedly this dramatic preoccupation that saved Browning, as it saved Dickens, from becoming submerged in the slough of dogmatism. For though he is the artist in portrayal, he is also the philosopher in interpretation. And through this he gives us his rationalized view of emotion.

It may be at first sight a disappointment to find the poet agreeing with the scientist as to the fleeting and distracted nature of our emotions. But this common premise is followed by a much more important conclusion, in which they also agree, that these same feelings, in all their strife and instability, are the stuff from which character is fashioned. Emotion is the raw material of character, and no matter how raw it may be, it is still material,—the thing without which no product of any kind is possible. Our emotions may be as unstable as water, but they are as necessary as water to life and as transmutable into more permanent forms.

"The Moral Hygiene of Emotion," says Professor Dewey, "is to utilize emotional disturbances for the intensification of the intellectual life." "Suffering enters Browning's poetry," says Herford, "almost never as the artless wail of the helpless striken thing. . . . It began to interest him when the wail passed into the fierceness of vindictive passion, or the outward calm of a self-subjugated spirit, or into speculative if bitter retrospect."

The sin of Duke Ferdinand and the Lady Riccardi (in 'The Statue and the Bust') was that they allowed their emotion to dry rot at ease, and consequently found their judgment day upon them unaware. The folly of Kate Brown and the sculptor Smith was that they rusted alive in a repression that gave neither romantic happiness nor artistic success. Far better for these and others 'to be dead of joy, James Lee,' than to lose both the joy and the potential value of the sorrow. 'Rabbi Ben Ezra' tells us that it is 'rage' that is 'right in the main,' and 'acquiescence' that is 'vain.' The crystallization of emotion into that sudden discovery of truth we call inspiration is portrayed directly through David in 'Saul,' and indirectly in 'The Last Ride Together,' 'Abt Vogler,' and Caponsacchi's experience in 'The Ring and the Book.' In these and other poems Browning exemplifies the advice of Lord Bacon that any painful destiny be 'not a dull and neglected suffering, but a wise and industrious.'

To Browning no emotion, not even love, is an end in itself but the means to the higher end of fine, dynamic living. Accordingly he has illustrated many times, particularly in 'Ferishtah's Fancies,' what Dewey calls 'the fallacy of Stoicism.' It is not the cold, unemotional nature that is the best type, but that of the strongest emotions kept under the firmest control. The whole problem of evil is solved by regarding pain as a stimulus to compassion for man, when he is smitten, and gratitude to God, when it is relieved. It was a realization of the truth that feeling is not the antagonist of reason but its ally, that enabled Browning the poet and Meredith the novelist to lift their characters to emotional heights with no danger of toppling over into bathos, because supported by rationality on one hand and a sense of humor on the other.

By one poet then at least we are assured that any instinctive resentment we might feel at the pronouncement of the psychologists on our ephemeral and discordant emotions will be more than mollified by the knowledge of their ultimate ideal career. In the sentiments, convictions, and intelligent behavior into which they may be transformed we may find the harmony and permanence essential to our sense of the dignity and significance of human life.

237

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DYNAMIC PSYCHOLOGY AND THE PROBLEM OF MOTIVATION

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There is undoubtedly a strong trend today towards a more dynamic psychology, one which will explain the 'particular go' of the mental machine, which will tell us *why* our minds act in certain ways and *how* rather than of *what* they are made. Three aspects of the general problem of motivation—which is central to any dynamic psychology—must be distinguished, if we are to reach clearness, though the three aspects in fact overlap. To continue the analogy of the machine—and this is at least a valid metaphor—we must distinguish first the mechanism of psycho-motor action, second its driving power, and third the end aimed at or motive in the narrower sense.[1]

Modern empirical psychology, which we may date somewhat arbitrarily from Hobbes, has been dominated by the hedonistic theory. Man is actuated or motivated chiefly or wholly by the desire for pleasure and the aversion from pain. Pleasure-pain is thus held to be both the driving force and the end aimed at, that is the motive. Hedonism as an ethical theory has a certain plausibility. Nevertheless it early met staunch opposition. As a psychological theory it is entirely inadequate, yet it remained up to the middle of the last century almost unchallenged. It was the uncritically accepted doctrine of hedonism which enabled psychology to go its even pace, untroubled by the problem of motives at all.

[1] Motive is sometimes used to include the second factor as well, or as a synonym for motivation in the wider sense we have given it here. The dictionary definition of motive as 'that which induces one to act' seems to me preferable.

The successful refutation of hedonism in the last century left a void in psychological theory disturbing to the complacency of even the most hardened. James, whom no one would dream of including in this class, made a valiant effort to supply the deficiency with his theory of ideo-motor action. This theory holds that every presentation or idea in its widest sense tends to run over into a motor response. It is impossible with our present knowledge of the nervous system to doubt this. It is the basic fact when we come to consider the mechanism of motivation. But James attempts to elevate this into a theory of will. All that you have to do to will, he tells us, is to hold an idea firmly before the mind. And having done this, the inherently impulsive nature of ideas will take care of the rest. Quite so; but how and why we are to hold certain ideas before the mind, we are not told. That James felt the inadequacy of his own doctrine, I cannot doubt. For one thing, he somewhat overprotests that this is all there is to it in the theory of will.[1] But as a solution of the specific problem of motives he has only the word interest to offer. We keep an idea before the mind in willing because it interests us.

Although he never worked it out in detail, James had a more satisfactory solution to the second problem of motivation. The driving power of conduct comes from our instinctive endowment. This is the thesis so powerfully set forth and defended by William McDougall. "We may say, then, that directly or indirectly the instincts are the prime movers of all human activity; by the conative or impulsive force of some instinct (or of some habit derived from an instinct), every train of thought, however cold and passionless it may seem, is borne along towards its end, and every bodily activity is initiated and sustained. The instinctive impulses determine the ends of all activities and supply the driving power by which all mental activities are sustained; and all the complex intellectual apparatus of the most highly de-

[1] It is unnecessary to deal here with James's second theory of will as the *fiat*. For the *fiat* comes in only when there is a conflict of motives. Until we have settled what these are, we cannot usefully consider their conflict and its resolution.

veloped mind is but a means towards these ends, is but the instrument by which these impulses seek their satisfactions, while pleasure and pain do but serve to guide them in their choice of the means." [1]

It will be observed at once, however, that McDougall here goes somewhat further than James. Our instincts not only furnish us with the *vis a tergo* of action; they also supply the *vis a termino*. Willed action is but the striving after the desired, and the desired is defined completely as the end towards which instinctive action tends, or as that which furthers such action. In his consideration of 'Motives in the Light of Recent Discussion,'[2] Mr. McDougall has lately reaffirmed his belief in the essential correctness of this view. The view earlier expressed which allowed a sort of secondary motivating function to habits, is now, however, given up. The emotions, that is the affective aspect of instinct, alone constitute our motives.[3]

The resultant simplification of the whole doctrine of motivation is most grateful. Why do I act thus and so? Because some instinct has been aroused by the circumstances in which I find myself. My impulsive action and no less my willed action is the result of innate determination. But when we compare this simplicity with the complexity of the motives which we feel to be actuating us, it seems somehow unreal.[4] I do not feel myself actuated at every turn of the day in my choices and behavior by some impelling instinctive drive. Occasionally, often as an excuse, I say that I did something 'instinctively,' but some of my choices are guided by "reason," others by habit, comparatively few are obviously dictated by instinct. From a surface consideration, therefore, it would appear that the simplicity of McDougall's

[1] 'Introduction to Social Psychology,' 1910, 3d Edition, p. 44.

[2] In *Mind*, 1920, 29, 277–293.

[3] Mr. McDougall doubtless means to include the more generalized instinctive tendencies and affections as well as the appetites. These are all described along with the emotions as contributing to desire in the Supplementary Chapter II of 'Social Psychology.'

[4] He does not offer us anything so absolutely *simple* as the Freudians, however, with their reduction of all activity to the sex motive. But McDougall's thought, even when he is theorizing, is still influenced by empirical considerations.

latest view is attained at the expense of certain facts. But although it thus stands in need of supplement, his viewpoint seems to the present writer not only valuable, but fundamental, to any tenable theory of motivation.

Perhaps if we consider first McDougall's rejection of pleasure-pain as a motive force, the type of corrective needed will be evident. "None of the doctrines of the associationist psychology was more profoundly misleading and led to greater absurdities than the attempt to exhibit pleasure and pain as the source of all activities. . . . Pleasure and pain are not in themselves springs of action, but at the most of undirected movements; they serve rather to modify instinctive processes."[1] But this is to pour out the baby with the bath. Certainly pleasure and pain, or liking and disliking as the writer prefers to call them, are not originally springs of action. Certainly liking is secondary to the satisfaction of some instinct. But hedonism could scarcely have attained such almost universal acceptance were it not true that men are, not merely occasionally, but frequently, actuated by the desire for some anticipated pleasure—*i.e.*, for a pleasurably tinged experience. Even though such experience could be attained only through the satisfaction of some instinctive tendency, it remains true in many particular instances that the dominating factor determining conduct is the desire for pleasure. Pleasure becomes not *the* good, as the hedonist falsely held, but a good for even the most ascetic.

It may be said that what one desires or wills is not pleasure but some pleasant thing, and that the pleasantness of this thing is due to its satisfaction of some instinct. Now pleasure is undoubtedly an abstraction, and we may doubt whether we can directly will an abstraction. Thus one's actual volition must be directed towards some specific action. But such action is distinctly a means to an end and the end in such cases is defined by the person's desire for pleasure, quite abstractly conceived. To deny this is to deny all function to general abstract ideas, to deny that they too are genuine ideas, the impulsive nature of which is the fundamental

[1] *Op. cit.*, p. 43, note.

thesis of the ideo-motor theory. Thus we seem forced to admit pleasure and pain (or liking and disliking) to the position of actual motives, though we may grant with McDougall that the driving force behind them comes from an instinctive disposition.

First then among the secondary or derived motivating forces of human conduct we may put the desire for pleasure. Are there any others? Habit at once suggests itself. Take the classic instance of the absent-minded professor who goes to his room to dress for dinner and actually undresses and goes peacefully to bed. Can we deny that here the 'drive' to use Woodworth's neat expression, is the force—the very expression is significant—of habit? Habitual dispositions as truly as instinctive furnish us driving power for action. To be sure, the energy of habit is rather potential and requires to be 'touched off' by the perception of some familiar situation; but precisely the same thing is true of the instincts. The human machine may be able consciously to determine its ends, but no more than any other machine is it equipped with a genuine self-starter. (What an absurd misnomer a 'self-starting automobile' is, and who would want one if it were possible?)

But habits also furnish us with motives in the narrower sense. It is a curious fact that McDougall who first called explicit attention to the affective (emotional) side of instinct should have overlooked it in connection with habitual conduct. Habit, to be sure, is used primarily to indicate movements—as is instinct too for that matter—and when that motor side is highly developed we call it skill. Now so long as we fix our attention upon this motor aspect, we may not hope to find any 'intrinsic drive' or motive. For the driving power of man is part of his affective equipment. But habits are more than mere skill. Habits are, like instincts, complex psychophysical dispositions, generally if not always including a cognitive, an affective, and a conative aspect. Indeed substituting 'acquired through repetition' for 'inherited or innate,' McDougall's well-known definition of instinct describes very well the nature of habit.[1] The cognitive aspect of such a disposition closely corresponds to the Herbartian 'apperceptive mass,' while the affective aspect may best be termed interest.

Since this doctrine of habit is somewhat new, it may be well to dwell upon it for a moment. There is a growing tendency to place interest definitely as a feeling. Drever argues, for example, that interest is the affective aspect of the instincts and that the emotions described by McDougall form only a special case. Woodworth calls the feeling that comes from innate capacities, interest. And we have noted that James uses this term as the keyword of his theory of will for that by which the idea is held in mind. On the other hand, the historic association of interest is with attention and with Herbart's 'apperception.' The suggestion here made combines the two uses. Stripped of its mythological elements, the Herbartian doctrine of apperception states that we have a psycho-physical disposition, acquired in experience, predisposing us to the attentive perception of certain kinds of objects; and the perception of such objects is tinged with an affective warmth which is called interest. When some of the functional psychologists, who were much influenced by the Herbartian tradition in education, pointed out the close relation of such a disposition to action, the parallel with instinctive disposition as later defined by McDougall was complete.

But our interests, theoretical or practical, in some one aspect or other of this psycho-physical disposition, constantly tend to obscure the essential unity of the conscious act or process of which it is the ground. Intellectualists speak as if man were exclusively a cognitive being. The functionalists, and more lately and more rabidly, the behaviorists, see in him merely a conative or acting being. Other anti-intellectualists follow McDougall or Freud in regarding man

[1] "We may, then, define an instinct as an inherited or innate psycho-physical disposition which determines its possessor to perceive, and to pay attention to, objects of a certain class, to experience an emotional excitement of a particular quality upon perceiving such an object, and to act in regard to it in a particular manner, or, at least, to experience an impulse to such action." *Op. cit.*, p. 29.

as primarily a feeling, emotional animal. Traditional systematic psychology, to which we might legitimately look for a corrective, has indeed seen that man thinks, feels, acts; but the treatment of each of these aspects has been, with few exceptions, so atomistic that one scarcely glimpses the fact that the separation of these functions is artificial, that they are merely aspects of a single, unified and essentially indivisible conscious act. The more or less permanent ground for such an act we call a disposition. One or other aspect of such a disposition may be to the fore at any given time; perhaps, in limiting cases, the other two manifestations do not show themselves at all. If the affective aspect be prominent, we are apt to speak of it as a sentiment, or as an emotion; if the cognitive is to the fore, we speak of perception, imagination, or thought; if the movements are the significant factor, we speak of instinct, habit or will or outer volition.[1] Where we are dealing with a disposition whose organization as a unit is inherited, we call it instinctive; no single term seems to cover all the manifestations of acquired dispositions. Habit, as emphasizing the repetition involved in its acquisition and the resulting facilitation of action, seems as well suited as any other. Let the name pass, the reality of such dispositional action is scarcely to be doubted.

Now no one doubts that such acquired or habitual dispositions are developed by a continuous genetic process from the innate propensities. (On the other hand, it is at least plausible that it is the attachment of emotions to acquired dispositions which so long obscured their instinctive origin.) But whatever the genetic relation to the instincts, the affective aspect of such an acquired disposition constitutes a motive which is genuinely intrinsic, independent of any drive outside of itself. The writer has had frequent occasion to observe the extreme emotional value for his young son of the habitual regime. Unless the black cast-iron dog with the yellow eyes sits in the upper right hand corner of his tray, his food has no savor and cannot be eaten. When mother and father to-

[1] Will is also used of course to denote a type of experience in which movements are not prominent—*i.e.*, in 'inner volition.'

gether take him for a ride, it is highly improper and not to be tolerated that mother should push him for even the briefest moment, though she may do so when alone with him. And how is it to be expected that he should hold father's left hand in walking, when he has always been accustomed to toddle along on the right? We need not go to the child; a pleasant little essay recently published in the *Atlantic* is full of examples of cherished customs. "No matter how common-place the origin, any simple, unvarying custom, followed for a long time, gathers power to stir the imagination."[1] Mr. McDougall challenges us to produce a single instance of the intrinsic drive of any motor habit. Let him alter any deeply rooted habit and see if there be no disturbance. The intrinsic drive of a habit comes out more sharply in the negative instance because of that retrogression into the subconscious which is the nemesis of all repeated experiences, whether their basis be instinctive or acquired.

As McDougall points out in his review of Woodworth, who puts forward a view somewhat similar to the thesis of this paper, there is nothing in all this inconsistent with the position taken in his 'Social Psychology.' There the interest is primarily genetic. As a geneticist, Mr. McDougall sees that the innate dispositions are fundamental to motives, and for his purpose that is enough. Unfortunately he sometimes speaks as if a careful analysis of actual motivation would disclose this origin, as if our concrete motives always bore upon their face the stamp of their instinctive origin. Often as this may be the case, it more often is not the case; else had there been no need for that exposition of the instinctive nature of motivation which we owe to him. Undoubtedly the social psychologist and the social scientist should be more interested in those dispositions which are common to the race (and these are always innately organized); since it is in these that he will find those springs of action which have moulded institutions and customs.

I do not mean, therefore, to belittle the importance of the contribution of the geneticist. That contribution consists,

[1] 'The Lasting Things.' *The Atlantic Monthly*, April, 1921, pp. 470–475.

firstly, in the emphasis upon the instinctive motives as actual immediate determinants of conduct. It is distinctly worth while to realize how much of our behavior is regulated by the same instinctive motives and motive forces as govern our fellows, not merely of our own nation and time, but of all men since man first was man.

Even more important is the recognition of a certain resistance in these inherited springs of action. The proponent of social control may be assured that the acquired motives and impulses can be, if necessary, remade. For all that is distinctive and individual in the acquired motives is due to their form of integration from the simple innate drives, and what can be thus put together can be disintegrated. Not so the innate springs of action. As Dewey says, our instincts give us a bias so strong that we cannot go contrary to them, though by trying we may pervert, stunt and corrupt them. The worldwide industrial unrest is being recognized as the result of the tremenduous repression of instinctive wants and desires, and their diversion into abnormal channels.[1]

Yet it is just here that it is important to recognize the reality of acquired motivations. The instinctive tendencies are limiting, even to a certain extent normative, to the acquired forms of motivation and to all schemes of social control based on them. But without these acquired motivations, the only alternative to repression is unbridled license for all our instincts. The judicious control of our motives, in the individual by habits and in society by custom, is the prime necessity for social life. The easy and dogmatic appeal to 'human nature' in support of this or that form of social organization must give way to a study of the manifold ways in which particular structures, satisfying certain instinctive demands while perhaps repressing others, are built up and supported by acquired motivations. It is only by taking due account of the effects of both heredity and experience that we can do justice to the variety of human life.

[1] Compare, *e.g.*, Carleton Parker, 'Motives in Economic Life,' *Proc. Amer. Sociol. Soc.*, 1918, 12, 131.

Conclusion

The plea, then, is for a broader theory of motivation than hedonism or the instinct theory recently formulated by McDougall. We must seek the dynamics of human behavior not merely in the innate mechanisms but in any relatively permanent psycho-physical disposition. The habit-dispositions, whose importance is thus emphasized, are to be thought of as parallel to the instinctive. Like these they give rise to a unitary psycho-motor response in which we may distinguish a cognitive, a conative, and an affective aspect. As a function primarily of the last, the desired ends of life are but the ends towards which some such disposition—innate or habit-acquired—is directed. This is the stuff of which our conscious motives are made.

PSYCHOLOGY AND THE CENTRAL NERVOUS SYSTEM

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The Province of Psychology.—In recent psychological literature we find two radically different conceptions of the science. (1) The older view, still widely prevalent, considers its chief task to be the examination of 'mental states,' 'states of consciousness,' or 'conscious experiences' of organic beings. (2) The newer conception, only recently developed in a systematic way, regards the science chiefly as an investigation of the 'behavior' or 'responses' of organisms to stimuli from without.

These two conceptions differ so widely that they are generally regarded as irreconcilable—they appear to psychologists and outsiders alike to represent two different fields of investigations. There is, in fact, considerable doubt on the part of each group of investigators as to whether the researches of the other properly belong within the pale. The investigators of conscious phenomena—the Introspectionists—question whether the study of mere motor expression is a legitimate concern of psychology; on the other hand the Behaviorists question whether introspective studies, however interesting, are legitimate objects of science.

To the present writer this mutual challenge between two sets of investigators in what is apparently a single field of 'natural phenomena,' seems to indicate that neither party has attained a sufficiently broad conception of the system of events which both are endeavoring to investigate.

If we lay aside our traditional prejudices and the bias attaching to the terms 'psychology' and 'behavior,' we cannot but admit the close relation between the events studied by the two groups. Both 'conscious experiences' and manifestations of 'behavior' are phenomena of *organic creatures.*

And further, except in the lowest creatures, they are intimately associated with the operations of the *nervous system.* If, then, 'mental states' and 'expressions of behavior' admit of scientific investigation—or to the extent that such investigation is possible—they appear to belong to the same general field of science. Behavior is not merely a branch of physiology; its data, *responses*, are a class of phenomena indicative of neural activity. Mental states or experiences are not merely subjective occurrences; they are somehow conditioned on the operations of the nervous system.

A balanced view of the field of psychology, then, would seem to make its central feature the *specific activity of the nervous system.*[1] Behavior may be regarded as the end-result of neural activity, and the conscious experiences which the introspectionists investigate are in some way 'bound up' with this same neural activity.

Furthermore, the really significant portion of the nervous system is not the conducting segments of its arcs but the *central* regions. This is definitely recognized by the introspectionists. The 'orthodox' psychology of today assumes a connection of some sort between the phenomena of consciousness and activity in the brain—more specifically, activity of the cortex. The behaviorists regard the muscular and glandular phenomena which they investigate as due to efferent neural activity from the centers. Their conception is the broader one, for they do not limit these centers to the cortex, but include any or all central points, whether in the cortex, lower brain, or cord (and possibly in the autonomic system). While this difference between the two schools is significant, its importance may easily be over-emphasized. The two have at least this in common, that they attach relatively slight importance to the afferent and efferent conduction paths, and agree that the main function of the

[1] This and the two preceding statements should of course be qualified so as to include the simple phenomena occurring in protozoa, which have no nervous system or 'neural activity' properly speaking. In these creatures an equivalent mode of activity is observed, though its structural basis is far less definitely organized. The term *specific* in the definition is intended to exclude the trophic phenomena of the nerve cells, with which psychology is not directly concerned.

nervous system is the integration of incoming impulses and the coordination of outgoing impulses—both of which occur at the centers.

Finally, both schools recognize the significance of the special organs at the two ends of the nervous arc. The receptor organs are stimulated by the environment, the effector organs give rise to responsive activity of one sort or another—muscular or glandular.

History has shown time and again that a science becomes more fruitful as it oversteps the bounds of 'classification' and becomes 'dynamic.' In biology, genetic problems have proved far more significant than the mere description and classification of animals and plants. So in psychology, the conception of 'adaptive responses' seems more significant than mere classifications of 'mental states' or 'types of response.'

The writer believes that the most appropriate and fruitful conception of psychology is to regard it as the branch which investigates all the phenomena directly concerned in organic stimulation, central adjustment, and response. More explicitly, psychology is the branch which deals with stimulation of organisms by their environment, central nervous activity resulting therefrom, and responsive activity of whatever sort consequent on this central activity. Responsive activity includes not merely glandular secretion and muscular contraction, but all the bodily changes and movements which result therefrom. All these taken together constitute in any given instance the creature's response to a specific stimulus or to the entire group of stimuli which make up the 'total situation.' The notion of *adaptiveness* is by no means implied in the definition; it is a matter for investigation to determine how far a creature's responses are suited to the situation and by what means they tend to become adaptive.[1]

The question at once arises whether such a conception of psychology really helps to bring the two lines of investigation together. Does it tend to unify the science, or does it merely

[1] The term *adaptation*, fitness of result, is not to be confused with *adjustment*, the linking up of sensory and motor impulses.

add a third alternative to the existing diversity? This standpoint, which has been developed by the writer,[1] has been identified with behaviorism by intropectionists,[2] but the behaviorists will have none of its 'introspective' features.[3] While this indicates that the standpoint offers a possible neutral meeting ground, it also shows that the conception has not been developed with satisfactory clearness. It may accordingly be worth while to examine the 'neurological standpoint' of psychology more fully and try to reconcile it with the introspective and behavior standpoints.

Central Nervous Activity and Consciousness.—The chief difficulty in attempting to bring psychology into line with the biological sciences lies in the traditional conception of 'mind' and 'consciousness.' Both of the historic views—Interactionism and Parallelism—while they differ radically from each other, regard mental phenomena as belonging to an essentially different order from neural phenomena. In either case there results a duplicate set of events, whose mutual relations are not made clear in any statement with which the writer is familiar. Psychophysical parallelism as a theory expressly refuses to put forward an hypothesis respecting the mode of relation. Interactionism admits a very definite relationship, but not of a sort that is of service to scientific research. Let us examine the latter hypothesis.

According to the interaction view, mind and the neural protoplasm of the brain are two different substances, capable of affecting one another. This is reasonable enough. When an incoming nerve impulse reaches certain regions in the *brain* it thereupon arouses a sensation or 'awareness' in the *mind*. A reasonable corollary. But what next? Does the mind thereupon, independently of brain activity, form an idea, a purpose-to-act, and a volition? Or does the nerve impulse pass from the sensory center to a higher center and *there* arouse an idea in the mind? What becomes of the nerve impulse while the purpose-to-act is forming, and how is the nerve impulse modified by the volition?

[1] 'Human Psychology,' 1919.
[2] See M. W. Calkins, Psychol. Rev., 1921, 28, 1–18.
[3] This I gather from comments in private letters and personally.

In a recent article[1] Professor M. W. Calkins suggests that the writer's chief objection to the interaction view is a fear that it may lead inevitably to indeterminism. This is by no means the chief objection to the view. For even if we can surmount this difficulty, as Miss Calkins believes we can, are we not assuming a *double set of machinery* to accomplish what a single set would accomplish equally well? If the complex nerve impulses, following the paths of least resistance, bring about certain motor activities, how does it assist our explanation to say that the *will* (a mental state or power) causes the movement by operating upon this nerve impulse? [2]

Since the days of Occam, science has recognized the importance of cutting out a multiplicity of causes. Here is apparently a case in point. Experiment indicates that the specific motor effects of psychocerebral processes are determined by the line of neural least resistance rather than by the conscious volition. If I select some act never before performed, and 'will' to do it, the mental determination has no result. I can determine to twitch my ears and can will to perform the act time and again—but no activity of the sort occurs. The nerve impulse does not follow the direction suggested by the will; it follows the path of least neural resistance.

Professor E. L. Thorndike some years ago[3] pointed out the fundamental error in the traditional ideomotor theory. According to that theory the thought of a movement tends to produce that movement. Observation and experiment, according to Thorndike, demonstrate that this view is erroneous. Granted that an idea (or its neural correlate) always tends to motor expression of *some* sort, there is no evidence that this expression will *in the beginning* tend to correspond to the idea. Only by chance variation, selection,

[1] Psychol. Rev., 1921, 28, p. 12.

[2] Dr. J. R. Kantor characterizes this view as assuming 'a mystic potency resident in consciousness' (Psychol. Rev., 1920, 27, p. 202). Ignoring the adjective, is the will really a *potency?*

[3] 'Ideomotor Action,' Psychol. Rev., 1913, 20, 91–106; cf. H. C. Warren, 'The Mental and the Physical,' Psychol. Rev., 1914, 21, 79–100.

and learning does an idea or a volition come to express itself in the appropriate way. If I chance to hit upon the proper efferent path to the ear muscle, and by selection and repetition fix that path, then in time the idea of twitching the ear will be followed by the actual movement as naturally and as certainly as in the case of any other voluntary movement. But if this is the case, then why attribute causal significance to the thought rather than to the neural correlate? Are we not assuming a duplicate set of 'agencies' to explain what may be explained quite as fully in terms of the neural correlate alone?

The reason why this dualistic explanation is so commonly accepted seems to be that psychologists are not accustomed to interpret mental phenomena in neural terms. The introspectionist observes that when a book lies on the table and stimulates his visual receptor organ he *thinks* of picking up the book and the proper movement then follows. His technical description includes the stages of *perceiving* the book, *deciding* (or willing) to grasp it, and making the appropriate *muscular contraction*. But we know that the perception part of the process is preceded by an afferent nerve impulse, for if the optic nerve be severed the perception does not occur. We know also that the later stages are accompanied by certain characteristic neural operations, for if the brain be disturbed in certain ways the idea, or the decision, or the muscular contraction (one or all) do not occur.

Normal and pathological investigation indicate, then, that the specific activity of the nervous system is highly significant at every stage of the process. We have no differential evidence to show whether or not 'consciousness' apart from the neural correlate is significant—whether its activity makes the result different from what the nerve impulses by themselves would accomplish.

This examination will indicate why the so-called 'double-aspect' interpretation appears a more useful working hypothesis for psychological investigation than the 'interaction' interpretation. According to the two-aspect view the 'neural correlate' is not a correlate at all; it is the *same set of events* observed in a different manner. The book-stimuli excite certain optic-nerve impulses which are conveyed to the brain; an integrative process occurs in the cortical centers. This cortex is part of my body. I am somehow identified with this particular brain, in a sense that I am not identified with the brains of other organisms. Is it a far-fetched hypothesis to assume that my mental life, my consciousness, *consists of* the neural activities in this particular brain? That the events which are observed (so far as they *are* observed) by the neurologist in the form of neural impulses, integrations, etc., are the same events which I, the personality of this organism, observe in the form of perceptions and other experiences? That there is actually but one set of primary occurrences concerned, which may be observed either *objectively*, by means of apparatus registering the nerve impulses, or *subjectively*, by living these events—by experiencing them as part of myself?

Various objections have been raised to the double-aspect hypothesis, which so far as they are not based on mere misunderstanding or faulty logic seem reducible to two: (1) The two sets of phenomena are so absolutely different that it is difficult to conceive how they can be regarded as two manifestations of the same set of events. (2) Even admitting the possibility of this unification it is of no scientific value, since the 'conscious' aspect has no causal significance.

M. W. Call
crit.

(1) The force of the first objection is readily admitted. I cannot picture a neural process as a perception, nor can I picture a perception as consisting of an intricate synthesis of neural activities. But does this at once condemn the hypothesis? I find it just as difficult to picture the relation of two separate interacting substances in any satisfactory way; and the parallel changes of two independent substances is quite as unthinkable. We are concerned here with one of the *ultimate facts* of the universe, and it is not to be expected that a satisfactory mental picture of the relation in question can be obtained in the present stage of investigation. Mere unthinkability or unpicturability[1] is not sufficient

[1] Philosophers appear to lay too much stress on this criterion. If an hypothesis accounts for the facts, what matters it whether we can 'picture' their relations or not?

ground for rejection so long as the other alternatives are equally unthinkable. Our choice of an hypothesis is to be governed by its utility in explaining the observed phenomena.[1]

(2) This brings us to the second objection. Has the double-aspect hypothesis no scientific value? On the contrary I believe it to be the most promising means of attacking psychological problems. Granting that perception, volition, and other subjective experiences have no *independent* causal significance in modifying the neural operations, they do furnish first-hand information as to what those processes really are. For example, the fact that one perceives a book as a unitary object indicates (if our hypothesis be adopted) that the separate nerve impulses from various parts of the retina are unified in some way. The fusion of two sounds into a complex auditory sensation indicates a different sort of composition of the neural impulses in auditory phenomena from that which occurs in the visual. Attention, the focalizing of certain parts of an experience with 'marginalizing' of the other parts, indicates some specific characteristic of the neural process.

Contrast this with the parallelistic hypothesis. Parallelism assumes as psychological data an absolutely detached set of phenomena—mental states, or operations—which throw no light whatever on the nature of neural activity. On this hypothesis we can indeed build up an introspective science of experience, but we may not use it in developing our explanation of the stimulus-response process. Parallelism is fruitful only so far as it goes over into a 'monism' of the double-aspect type. The more the two sets of *phenomena* are reduced to a single set of *primary occurrences*, the more unitary does psychology become.

Here we may appeal again to our scientific canon of simplicity or paucity of agencies. It is not only more fruitful, it is more justifiable on general scientific principles, to assume a single set of events manifesting themselves in two

[1] Whichever view is adopted is taken merely as a working-hypothesis. The writer shares Miss Calkins's objection to introducing 'metaphysical theories' into psychology (*op. cit.*, p. 12); but how can we avoid taking a tentative attitude on this particular problem?

sets of phenomena—'objective' neural processes and 'subjective' experiences[1]—than to assume two independently working, yet harmonious sets of events.

Central Nervous Activity and Behavior.—The behavior method of investigating psychological phenomena has a distinct advantage over self-observation as a scientific procedure; it permits quantitative measurement of the phenomena under consideration in terms of well-known physical standards. The older form of introspection gave only qualitative results and rough numerical approximations.[2] Experimental psychophysical investigations, which subject introspection to laboratory conditions, are exact and quantitative only in so far as they include behavior factors. The duration of the perception and recognition processes are measured by means of reaction time—that is, response time. Discrimination (just noticeable difference) is either measured with the aid of some muscular response—separating the lighter from the heavier, stopping the changes of a variable stimulus, etc.—or it is indicated by some verbal response, such as 'now,' 'equal,' 'stop.'

The behaviorists very properly lay stress on the fact that *some* responsive activity is always requisite before the 'introspective data' can be used. From this fact they draw the illogical deduction that recognition and discrimination themselves are types of behavior. When I lift certain pairs of weights and place the heavier each time at the right, the discrimination process (they say) is the *act* of placing the weights in this order; when I report by such words as 'greater,' 'now,' etc., the discrimination is the *act* of verbal response.

In a recent article[3] Dr. J. R. Kantor seeks to explain perception in strictly behavioristic terms. "Perception," he says, "is the conscious behavior through which are developed the meanings of objects and relations which operate in the adaptation of the individual to his surroundings and in the

[1] Consciousness, according to this view, is merely a name for the specific characteristic of subjective experiences.

[2] *E.g.*, the number of different color-hues, auditory tones, etc.

[3] 'Suggestions toward a Scientific Interpretation of Perception,' PSYCHOL. REV., 1920, 27, 191–216.

control of them. The act of perception is an adjustmental reaction, an actual interaction of one object with another."[1] According to his view the act of perceiving is a motor process —not an occurrence in the central nervous system.

Watson

Further, the behaviorists assert that memory, 'imagery' of every sort, and thought itself are motor in character. When I think, the process consists in very faint vocal expressions or in vocal attitudes. So-called imagery consists in minute responses which reproduce faint stimuli and thereby reinstate minute sensations similar to the previous sensation, though far lesser in degree.

There is surely a logical fallacy in this assumption. Granting that the central nerve activity is always followed at once by a motor impulse and response of some sort, it does not follow that such responses are the *essential feature* of the perceptual, discriminative, and imaging processes. They may be merely by-products.

The degree of heat in a room is indicated by the height of mercury in a thermometer bulb. But the rise and fall of the mercury column is not the essential or characteristic feature of the heat phenomenon. So long as the thermometer is present it enables us to measure accurately the degree of heat. But if the thermometer be destroyed by some accident, the heat variations still continue, though we may be unable to measure them.[2] In the absence of crucial evidence we are only justified in regarding behavior phenomena (general and vocal) as *indicative* of certain central phenomena. Motor expression *follows* the central nervous operations known as perception, discrimination, thought, etc.; it may serve as a measure of these central operations; but until the exact relations of the motor to the central phenomena have been determined we are not justified in treating the two as equivalent—we are not warranted in identifying the central phenomena of discrimination and thought with the response phenomena which they produce. When the behaviorist

[1] *Op. cit.*, p. 192.

[2] To vary the illustration, the earth's magnetic current is active whether or not we observe it with a compass.

makes this substitution he is guilty of the 'thermometer fallacy.'

It should be noted that this criticism is directed merely against the *line of argument* used by the behaviorists; it does not claim to demonstrate that the behavior data are *not* adequate indicators of the central processes. That is a matter to be settled by crucial experiments. The behaviorists do indeed point to certain very significant evidence. With delicate apparatus for measuring the changes in the vocal organs, for example, it is found that 'silent reading' is accompanied by minute but significant vocal expressions. 'Attention' is accompanied by minute muscular changes. The automatograph registers slight hand movements in cases of 'silent thinking.'

Is this evidence crucial? I believe not. According to Mill the canon of Agreement by itself is not sufficient proof; it is convincing only when combined with the canon of Difference. We can conclude that behavior is essential to thought only if it be shown that in the absence of expression there is no central thought process. One clear case of thought without expression would be enough to render the theory untenable.

I know of no experimental study that furnishes the data requisite for a final decision on this point. But it would seem to be not impossible of solution. Supposing an observer be given a complicated problem to solve, involving a series of rational operations. If thought consists essentially in motor adjustments, then *each step* in solving the problem will require a separate efferent impulse, an attention-response, and an afferent impulse, before the next step can begin. If, on the other hand, thought is essentially an affair of the central nervous system, then each step may consist merely in some complex central activity which is transformed directly into some other central activity *without intermediate behavior.* We know within limits the time required for transmission of nerve impulses along the conducting nerves. If the time for accomplishing a complicated train of reasoning be *so short as to preclude a succession of motor responses and return impulses*, then it would seem evident that the behavior phenomena are not essential to thought—that thought is essentially a central nervous operation. The experiment seems well worth undertaking. If satisfactory it would either demonstrate the falsity of the behaviorists' contention, or it would furnish fair presumption that their assumption is valid.[1]

In the absence of this crucial evidence I am inclined to reject the behavioristic assumption. Possibly this is due to prejudice, on account of its association with the thermometer fallacy. But there is also a positive reason for emphasizing the central phenomena over and above the expressive. There are instances of pairs or groups of responses which are quite different, yet which are obviously equivalent, where the 'equivalence' can be traced to the central nervous operations.

I write the words 'Next Tuesday' very fine, using only the muscles of the finger joints with slight wrist movements; then I write the same words in eight-inch letters on the blackboard with fingers and wrist perfectly rigid, using only the muscles of the elbow and shoulder. The efferent paths and muscles concerned in the two cases are entirely different; yet the two responses are so homologous that one can readily identify them as the writing of the same individual. (See Fig. 1.) Or, I hammer the words on a typewriter, click them off on a telegraph key, set them up in type, scrawl them stenographically. Here also there is a general equivalence between the various responses, though of a different sort. Or, I utter the words, 'mardi prochain,' 'nächste Dienstag'; these are in a sense equivalent to all the former responses. The psychological relation between these various responses is not brought out by a study of behavior. It is certainly dependent in a measure upon the stimuli, upon the general situation which led to the responses. But the basis of the 'equivalence' between such different responses seems to lie primarily in the central nervous system.[2]

[1] The same test would decide the value of the functionalist assumption that consciousness is determined by the total process, including the motor response. The alternative is to identify consciousness with the receptive and central processes, whether the reaction takes place or not.

[2] Has not too much emphasis been laid on the 'common final path'? Are there not as many cases of a common *initial* path (from the receptors) with different end paths?

What we need especially is a theory of central nervous activity that will explain (1) how two motor currents, going over different groups of paths (*e.g.*, to fingers and to elbow) will bring about movements which are geometrically similar within a very small limit of error; and (2) how motor currents can be sent out producing sets of behavior which are physically

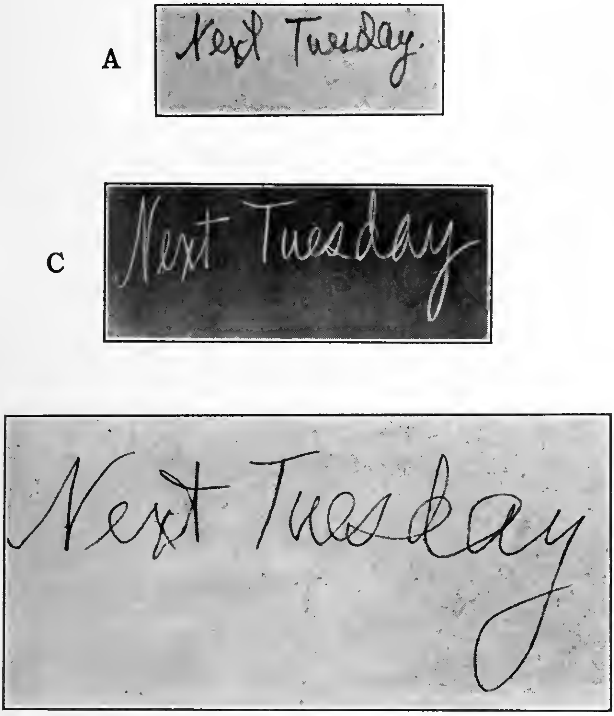

FIG. 1. Handwriting with Different Muscles. *A.* Finger movement only. Height of letters 2/16 + 2/16 + 3/16 = 7/16 inch. *B.* Wrist movement mainly. 3/8 + 4/8 + 8/8 = 15/8 inch. *C.* Elbow and shoulder only. 4 + 4 + 5 = 13 inches; written with chalk on blackboard.

incommensurate with one another (writing, vocalizing in various languages) and yet which have practically the same 'significance.'

It would seem that the behavior method, taken by itself, promises little hope of solving these problems. Behavior undoubtedly gives many clues to the nature of the central processes but only in connection with 'self-observation' (introspection) and neurological experiment.[1]

Use of Neural Data in Psychology.—It is a striking fact that little psychological information has been obtained by a direct study of neural activity. Psychology rests today almost wholly on investigations of conscious experiences and behavior. We know considerable about the paths of conduction from various receptors and to various effectors. We know somewhat about the centers concerned in connecting up the two ends of the arc. But we know little about the nature of the nerve current.

At least two general problems of nerve physiology are of vital importance to psychology: (1) What variations is the individual nerve impulse capable of undergoing? (2) What is the mechanism of the complex arc, whereby many simple afferent impulses unite into a complex central impulse and whereby a complex impulse results in coordinated motor activity?

The difficulties connected with the direct investigation of these problems are patent. Little can be accomplished by present methods in the way of studying the activity of individual neurons *in situ;* and the study of isolated nerves by artificial stimulation yields results whose validity may be questioned in several particulars. Is the process of electrical stimulation, investigated by physiologists, comparable to the effects produced in the neuron by natural stimulation? One cannot but feel some doubt. For the most part physiological experimentation has been confined to nerve-muscle preparations. Now the nerve certainly acts as an electrical conductor, and the result of electrical stimulation on such a preparation will obviously produce muscular contraction whether the 'current' is analogous or not to the natural nerve impulse. Is there satisfactory evidence that the artificial transmission process in the neuromuscular preparation is analogous to the natural activity of nerve? As a rank outsider

[1] Professor J. B. Watson has done yeoman's service to psychology in forcing the recognition of the behavior method. It is only when he refuses to recognize the legitimacy of other methods of investigation that we part company.

in physiological technique I realize the rashness of offering criticism. But certainly we must not ignore the possibility that the natural nerve impulse may be essentially chemical [1]—that the electrical phenomena may be mere adjuncts. And if this be actually the case, do not some of the physiologists' conclusions call for revision?

1. The specific conclusion which with great diffidence I am inclined to question, is the qualitative uniformity of the nerve impulse.

It is not easy to reconcile the results of introspective psychology with the notion of qualitatively uniform incoming impulses. Certain stimuli (light and sound, for instance) present two independent variations, *intensity* and *quality* (periodicity); the corresponding sensations also show two independent variations, *intensity* and *quality*. It is difficult to understand how external phenomena with two variable factors can give rise to corresponding experiences[2] with two variables unless the nerve impulse also varies in two independent ways.

Working with electric stimuli and electric currents in the nerve, one would expect to discover only intensity variations and not variations of 'sort.' The observation of activity in efferent nerves and muscles affords no opportunity for testing whether the nerve impulses vary in a two-fold way: here we have only the phenomena of contraction and relaxation. But chemical changes offer opportunities for qualitative as well as quantitative variations. Metabolism may result in a variety of chemical products as well as in different degrees of change. If the nerve impulse is essentially a chemical process, it could transmit the two-fold variation to the centers.

2. What is the mechanism of complex coordinated movements? How is the current distributed in the proper proportions and in proper temporal sequence, so as to produce

[1] Some slight metabolism has been found in active nerve.

[2] It seems scarcely necessary to assume with Mr. S. Bent Russell that the central data are *similar* to the stimuli (Psychol. Rev., 1920, **27**, 234–245). All we have to account for is a one-to-one relation of intensities and qualities in the two cases.

just the right complex movement? Compare the movements shown in Fig. 1. From the centers the impulse is shunted in a corresponding fashion into two entirely different sets of efferent pathways in the first and third cases. The equivalence of these two results seems to depend on something more than merely the relative tension at the motor synapses. It seems to imply some definite qualitative character of the central impulse itself.[1] In other words, the passage of the impulse over a certain synapse apparently depends not merely on the degree of resistance of that synapse; it would seem to depend also on *whether the particular impulse* (or some phase of it) *is adjusted to the condition of that particular synapse.* The condition of the synapse may be a function of previous impulses and of the *sort* of traces which they have left, if we assume that the nerve impulse is essentially a metabolic activity.

These two problems illustrate the close interconnection between the three different methods of psychological research. The results of the neural method are tested in the first case by the method of self-observation, in the second case by the behavior method. If these three methods of research be recognized as equally legitimate in psychology, it would seem that they might be used to supplement one another in many ways.

One application of this, suggested by the writer,[2] is in the correlation of the fundamental 'operations of conscious experience' with the operations of the neurons. Regarded solely from the standpoint of introspective psychology it is difficult to appreciate the mutual relation of such processes as sensation, revival, attention, discrimination, association. This is shown by the various ways in which they have been treated by different authors. In practically no text are they viewed as a group of coordinate operations. The problem is this: Assuming that mental states (experiences) imply corresponding neural conditions, and that each essentially

[1] The qualitative difference may be due to different chemical changes or to some difference of periodicity. To avoid bias we may call it difference in *mode*.

[2] 'Human Psychology,' ch. V., VIII.; see table, p. 144.

different mental operation means some distinctive neural operation; what is the least number of independent operations that can be noted in the two fields, and how are they correlated? Without contending too strenuously for the sevenfold scheme proposed in 'Human Psychology' the writer would strongly urge the principle on which it is based, namely, of translating the 'introspective' data at each point into terms of neural activity. Conscious revival corresponds to neural retention; attention to metabolic variations, etc.

A result perhaps worth while in itself is that this standpoint differentiates sharply between structural and functional data. There is no tendency to confuse 'mental states' with 'mental operations.' Perception, memory, thought, and the like are not fundamental operations at all; each consists of several operations upon elementary sensory data. Perceiving includes the functions of (*a*) impression, (*b*) combining the data, (*c*) focalizing certain data and marginalizing others. The structural product (a perception) is a synthesis of data derived mainly from the external receptors. And so for the rest of the traditional 'faculties.' The structural distinctions are based upon the stimuli—upon something outside the nervous system; the functional distinctions rest on the different characteristics of neural activity. This at least is the conclusion drawn from combining neurology with self-observation. Neither the interaction nor the parallelistic standpoint enables us to use this combined method of research, on account of their inherent dualism. The double-aspect hypothesis finds it natural to compare the two sets of data and to reduce them to one.[1]

Though little has been done in the way of physiological examination of nerves *in situ*, pathological investigations of neural conditions have borne considerable fruit. Disease and experimental extirpation of nerve substance have done much to identify the regions concerned in neural activity.

[1] Miss Calkins is wrong (*op. cit.*, pp. 9, 10) in interpreting me as holding that the central processes are facts only by inference, and that it is impossible to observe them directly. If we have not succeeded in doing so it is the fault of our instruments. I have never been in Brazil; this does not mean that it is impossible for me to go there.

The afferent and efferent pathways serving various peripheral regions have been traced in the cord and lower brain and many important cortical centers have been identified. The bearing of this localization on psychological problems has been lately discussed by Dr. S. I. Franz.[1] He reaches the conclusion that the higher centers, at least, are not specific to the functions which they serve—that one center is capable of assuming the function of another if the latter be destroyed. This conclusion, based on evidence from cases of reëducation, is important for psychology. It means that central adjustment depends not so much on structure (types of cell) as on process (on connections being actually established). If vocal speech can be relearned when the usual vocal speech area of the cortex has been destroyed, evidently the speech function depends on certain integrations and coordinations—not on the locality or kind of tissue in which the adjustment takes place. We thus reach the picture of a complex central impulse, the same however and wherever integrated, which is the characteristic 'adjustment phenomenon' of any given type of neural activity. According to the double-aspect hypothesis these central impulses are the data of self-observation; they are our experiences.

This line of research will perhaps assist us in explaining the loss of vivid consciousness in connection with habitual acts. As an action becomes learned, it tends to proceed with less and less awareness of its successive stages, till in time it may become quite automatic: we may be entirely unaware of performing it. The common explanation is that in the course of learning the lower centers come to control the act and the higher centers drop out. But if learning is the fixing of certain pathways, then it is difficult to reconcile this fixing of paths with the abandonment of the fixed path for a short-cut. What we do have, however, is an integrated experience —and an integrated central impulse. It may be assumed that as the act is learned the integration becomes more and more complete, and that in the end the impulse goes directly from one higher center into the motor paths, instead of

[1] Psychol. Rev., 1921, 28, 81–95. Dr. Franz favors the parallelistic hypothesis.

passing first through a number of centers, with gradual integration and coordination.

Summary.—The conflict between introspective and behavioristic conceptions of psychology is avoided by emphasizing their common features. Both deal with effects of stimulation upon the nervous system. Introspective psychology studies the *receptive* phase of the process—awareness of the environment. Behavior psychology studies the *responsive* phase—the creature's reactions upon the environment. Introspection (or self-observation) and behavior may thus be regarded as different methods of investigating a certain definite system of facts: the phenomena of stimulation, adjustment, and response by means of the nervous system.

The traditional psychology may be brought into line with this scheme by adopting the double-aspect view. The prevalent conceptions of the mind-body relation, both interactionism and parallelism, are dualistic, and by separating the two sets of phenomena they prevent the unification of the science. The hypothesis urged in this paper is that mental and neural phenomena are merely two manifestations of a single series of events. Its adoption as a working hypothesis is shown to be in accord with our best canons of scientific procedure. It enables us to use self-observation as a method of investigating the central part of the stimulus-response process.

The behavior psychology may be brought into line with this wider view if we recognize that behavior is merely the end-result and that it is essentially determined by operations in the central portion of the nervous arc. Behaviorists are inclined to emphasize the adjustive effects of the motor processes on the total response. They regard thought as consisting of implicit motor expressions, which serve as secondary stimuli and modify the final overt motor response. This assumption is apparently an instance of the 'thermometer fallacy.'

In this paper it is argued that the essential adjustment operations are central. Characteristic responses may be obtained *before* the implicit control responses are effective,

in which case they would be determined solely by central conditions and by the nature of the stimuli. If this be true, then the central process, not the response, is the significant feature of neural activity. Two crucial tests of this were suggested: (1) The similarity or 'equivalence' of pairs of responses involving different motor paths and muscles. (2) The short duration of extended trains of thinking, which seems to preclude intermediate vocal reactions between each pair of successive terms. If the operations in the central portion of the nervous arc are the essential feature of the stimulus-response process, then behavior and introspection are two coordinate methods of psychological investigation. Both seek to study the central processes which adjust the response to the stimulus.

Attention is called to a third method of psychological research—the neurological. The results of physiological research on the nerve impulse are important for psychology, particularly any light which they throw on complex impulses, the nature of neural retention, and synaptic activity. The results of brain research, by artificial excitation of centers, extirpation, and disease, all belong to this neural method of psychological investigation.

We thus find three distinct methods of psychological research: *self-observation*, *behavior*, and *the neurological*. The hope of psychology lies in their cooperation. Self-observation, for instance, may indicate certain features of the neural processes (*e.g.*, retention) which the neural method is backward in discovering. Behavior may reveal certain central phenomena (*e.g.*, subliminal discrimination) which self-observation does not indicate. Neural research may point out certain details (*e.g.*, the hierarchy of brain centers) which neither self-observation nor behavior has brought out.

Briefly, the natural standpoint of psychology is neither introspective nor behavioristic.[1] Psychology is concerned with a certain very extensive field of occurrences, namely,

[1] Nor yet the investigation of 'selves' as Miss Calkins views them. The writer regards the self, or personality, as a developed organization which includes neura structure, experiences, and attitudes.

all phenomena concerned in the interaction between environment and organism that belong to the stimulus-response type. These phenomena constitute a closely related group and form a natural 'brand' of science. The three methods of research are equally legitimate. The attempts of partisans of any one to outlaw the other two are due to lack of perspective. If, as is here contended, the central portion of the nervous arc is most significant in the process, then the fundamental concern of psychology is with the operations of the central nervous system. All three methods throw light on these central operations. Neurology, behavior, and self-observation are all needed for a broad, systematic development of the science.

APPERCEPTIVE ABILITIES

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Definitions and Discussion

Is there any justification for the use of the term apperception? Is apperception a mental process to be distinguished from perception, on the one hand, and, on the other, from certain so-called higher mental processes, such as reasoning and foresight?

Reviewing the accepted textbooks on psychology we find that in some the word apperception does not even appear, while in others it is used with a wide divergence of meaning. Briefly: (1) Angell does not use the term, but he discusses perception as a synthetic process, a process of combining the new and the old, whereby form and meaning are given to the new. (2) In Calkins, 'perception as assimilation' is briefly presented. (3) James regards perception, recognition, interpretation, elaboration all as synonymous. No use is made by him of the specific term apperception. (4) Pillsbury says that memory images help to interpret new material; hence the function of perception is 'to see into things.' (5) Titchener, considering apperception, states, "It is a question whether there is any real gain in the introduction of the term," and reaches the conclusion that 'perception' is adequate without the use of 'apperception.' (6) Thorndike does not include it in his 'Elements of Psychology'; he says, "Every act of perception is really an act of association or assimilation."

Turning to some of those who use the term, we find that (1) in Baldwin's dictionary apperception is defined as "the process of attention in so far as it involves interaction between the presentation attended to, on the one hand, and the total preceding conscious content together with performed mental disposition, on the other." (2) Dewey devotes some pages to the discussion and defines apperception as "that activity of the mind in which the significance is brought out through becoming explicitly conscious of relations involved." (3) Münsterberg says, "A perception in which the relation to other objects predominates is apperception." (4) Stout goes into the matter in great detail; his general position is that understanding, interpreting, identifying, subsuming, all involve apperception, the common feature being that the new presentation develops significance by connecting it with some mental preformation. (5) Wundt uses the term to designate the process by which any content is brought to clear comprehension. (6) Warren in his recent book, 'Human Psychology,' uses the term with an entirely different meaning, giving as an equivalent expression, 'focused perception.' He states that apperception is a phase of the perceptual process whereby certain elements of a situation or certain stimuli from among a group become 'focused' or clear.

Finally, in education the term apperception has been greatly used ever since Herbart laid such stress upon it—here of course it means specifically the interpretation of the new in the light of the old, the process by which new presentations align themselves with old elements, thus forming systems of ideas.

Among the first group of opinions 'perception' involves the idea of assimilation; the perceptive process refers usually to the recognition or identifying of some object, *e.g.*, an orange or a table is perceived when it is recognized as such, possessing all the attributes which previous experience has shown it to possess. The object is then 'perceived' or 'apperceived.' The most common feature of the second group of definitions is the inclusion under the term apperception of the ideas of significance, interpretation, relationship.

Perhaps to differentiate apperception from other mental processes, to try to find any distinctions between it and them, to see what it is *not*, may help to clarify and limit the meaning. Apperception is not mere recognition or perception of an object or idea, it involves much more the element of relation. Nor is the distinguishing feature merely memory or association, though both must be present to some extent; they, of course, are the prime elements in the perceptual foundations of apperception. Again, though reasoning also may be involved yet there is a distinction; even with reasoning reduced to a minimum apperception may be present. Apperception has in common with reasoning the need for judging which of the elements of a situation are the essential ones, but in apperception there is not necessarily awakening of a full round of associations or known facts.

Although (as we shall see later) sometimes classed as belonging with imagination and invention, apperception does not require invention of any data, for all the data are given; the essential process is that of seeing the relations between supplied data, whether observational or ideational. Nor can it be altogether satisfactorily regarded as a 'combinatory' process, for in combining one may put together anything. One may add 2 and 2, or 2 and anything else, sometimes even with the avowed purpose of producing some ingenious or fanciful result. Indeed, as Warren says, invention is combining phenomena into new forms. Apperception does not do this.

In an interesting paper, 'The Mechanics of Intelligence,' Warren, discussing types of intelligence, speaks of the intelligence required in adjustments to new situations. He analyzes the intelligence involved in the playing of games, citing chess as an example, and says that aside from learning certain principles or moves there is required here the choosing between possibilities, none of which *obviously* outweighs the others, and the determining from move to move what is to be the next procedure.

It seems clear that in so far as each move is decided upon in its relations to the whole plan of procedure, apperception is involved and forms the basis for determining which of the possibilities, apparently equally good, is in reality the best. In this case the apperception concerns itself with the relationship between the immediate situation and the future possibilities. As the game proceeds there is at each move a resizing up of the situation, perhaps a change in plan; the apperceptive process is here constantly in play. So, though in apperception foresight is not always involved, yet, contrariwise, foresight always involves apperception; indeed foresight is a kind of apperception.

To return to a positive statement regarding apperception, we may say that it deals with an immediate situation, in which the main problem is concerned with the relations between two or more elements, present or to be realized. It is the interpretation of two or more features of a situation, each in light of the others. The perception of these features may be readily accomplishable. Reasoning may be more or less involved. The apperceptive process is not as simple as association, the relationships to be grasped are not so much a matter of mechanical habit, they require more thought. And yet they are not so undetermined and new as to require creative imagination. Apperception is in fact the 'sizing up of a situation,' the interpretation of all the aspects, each in the light of the other, a 'seeing into' an immediate situation, however the latter may be presented.

We may illustrate what we have in mind by the Healy[1] Pictorial Completion Test II, in which there are 10 pictures each representing some activity of the same boy. Let us take the picture where the boy is walking to school. There is no single feature in the picture which cannot readily be perceived and understood—the boy is walking along, a fence behind him—he is swinging his books, the strap is loose. A little study of the picture shows that something has probably fallen out of the strap. The reasoning required for the correct solution is also easy. As we see by the preceding picture he had three books. He now has only two books—what is missing? Studied as a problem in reasoning it is absurdly easy, yet as a matter of apperception our experience shows that it is fre-

[1] This test, completed in 1919 and used as part of the performance scale of the Army, is described in the June, 1921, number of the *Journal of Educational Psychology*. Directions for giving and norms are to be found there.

quently misinterpreted. Instead of the missing book, the lunch box or the pencil box may be placed. Sometimes even the dog is inserted in the blank square. The correct solution depends upon sizing up the situation, upon interpreting it in the light of the relationships; it depends upon seeing that some one alternative outweighs another, though not *obviously* so unless the *relationships* are appreciated. Had the boy not started with three books it would be equally as logical to place in the square the lunch box or the pencil box, either one of which might have slipped from the strap.

If our definition of apperception is accepted there can be little doubt of its great importance to the individual in many circumstances of life. The ability to see the relation between things, to interpret a situation sensibly and intelligently is exceedingly necessary and valuable. Apperception is an activity constantly used. It is, as Dewey says, "That activity of the mind in which the *significance* is brought out." It is essential in meeting everyday experiences, in perceiving our relations to other individuals; indeed it is one tremendously important and essentially conditioning aspect of behavior.

Estimating Apperceptive Abilities

What means are available for gauging an individual's apperceptive abilities? Are there any tests specifically designed for this purpose? To what extent do so-called tests for general intelligence measure these capacities, and to what extent are they incidentally measured by other tests commonly in use?

Again first considering the literature on the subject, we find several points of considerable interest made by the formulators of so-called age scales. Terman, in 'The Measurement of Intelligence' says that defining chair, fork and similar words "throws interesting light on the maturity of the child's apperceptive processes." This is hardly in accord with our definition of the term, apperceptive process—the child certainly is not sizing up the situation, seeing the relationship between various aspects when he defines in terms other than those of use; he knows the percept, probably the concept, chair; how he defines it depends very largely on the stage of his language development and perhaps on how easily he thinks his examiner may be satisfied. It is the method of expression that is the point. Binet, speaking of this test, states that it gives an indication of the child's general notions and of his ability to put simple ideas into words. Of this same test it is stated in the Yerkes-Bridges Point Scale that it calls for ideation, association and analysis.

This is the only use of the term apperception found in Terman's book; in the analysis of no other test do we find him using the word, but there is considerable discussion about the 'completion test' idea, of which we shall speak later when considering the Ebbinghaus test.

In the book on the Yerkes-Bridges Point Scale, a modification of the Binet-Simon tests, we find interpretation of pictures singled out as involving, among other mental processes, apperception. No doubt in 'explaining the picture' the child does interpret, picking out what to him is significant and interpreting this in the light of relationships. At least, this occurs at the higher ages, when meaning rather than enumeration or description is stressed. But the answers required are meager and the test first appears at the fifteen-year level, so that very little gauge of apperception is offered.

Several tests included in age scales may properly be discussed briefly here though they are not incorporated in the scale to measure apperception, according to the authors. The analogies found in the Yerkes-Bridges Scale require comprehending relationships between two nouns and stating the same relationship between two other nouns. Here apperception is needed, as it is in the so-called mixed relationship test, but there is much less of the element of determining the essentials, less of what we have called sizing up the situation. There are no seemingly obvious other possibilities, the main one to be decided upon, for the single relationship to be realized is already picked out. According to the authors of the scale this test requires logical judgment based on analysis, reasoning, attention and memory.

The absurdities test, found in all age scales, is another instance where the relationship between ideas is essential in the solution. Terman calls this a test of critical powers and of judgment. The authors of the Yerkes-Bridges Scale call it a test for logical judgment based on imagination, analysis and reasoning. The critical power or logical judgment involved depends upon seeing that the relationships expressed in the anecdotes are irreconcilable, that is, the relationship itself is not to be formulated by the individual being tested, but he must appreciate it in order that the statement be recognized as impossible. In other words, apperception is involved in so far as one cannot be critical about a situation unless he grasps the import of the situation.

We should regard the Ebbinghaus Completion test as one requiring apperception; Whipple placed this well-known test among tests of imagination and invention, calling it a 'combinatory' test; he lists it with the ink blot and some other tests. He states that if the Ebbinghaus test is easy, it becomes virtually a test of controlled association; if difficult, a test of creative imagination. Terman thinks this test involves command of language and to some extent memory and association; Pyle, that it is to some extent a test of reasoning capacity.

Trabue, who has modified the original paragraph form of the Ebbinghaus test into separate sentences increasing in difficulty to form a scale, makes only the general statement that the scale measures ability along certain lines closely related to language. Surveying these opinions we see that there is no considerable agreement between the views regarding the Ebbinghaus test and its modifications. Language, of course, is involved. One must both understand the portions of the sentences given and have at his command a vocabulary adequate to supply the missing words. Where the idea expressed is very simple, the missing word can be supplied by easily controlled association, *e.g.*, "Good boys ———— kind ———— their sisters." But as the sentences grow more and more difficult it becomes necessary to grasp the meaning of the parts which are separated by the elisions and to find a true relationship between them. We cannot agree with Whipple that imagination and invention are largely involved, and that independent, even seemingly contradictory impressions are to be combined. The relationship between the ideas may be stated by inserting words similar in meaning, but the idea itself does not permit invention, it is clearly determined; the parts are not independent, there is supposed to be and is a relationship which obtains no matter with what words the elisions are filled. Thus, in the Trabue tests, language is the tool and the prerequisite for success in all the sentences, but in the more difficult, at least, apperception would seem to be required. A large element in the practical value of the test is dependent on the language ability which unquestionably complicates the result as far as gauging apperceptive ability is concerned.

Most similar to language completion tests in some ways are the Healy pictorial completion tests. Here there are omissions, but of parts of a picture instead of words. In both, the subject who is being tested has a certain situation presented, one pictorially, the other in words. In both the subject has a stock of ideas from which to draw, the one pictures, the other vocabulary. Reasoning, as such, in both is very simple and neither involves much foresight. The simple situations in the Healy pictorial test differ from the simple sentences of the Trabue, which may be solved so largely by association. The Trabue sentences also give aids which minimize the necessity for recognition of relations as in phrases where idiomatic forms are so well associated in the memory. So we see that in filling out the Trabue sentences appreciation of relationship of ideas is not always needed.

In the Healy pictorial test situations are presented in a form that does not depend upon knowledge of language. The situations pictured are all well within ordinary experience; hence the perceptions should be correct. What is mainly required is sizing up of the situations, interpreting them, seeing the relationship between the activity depicted and the missing piece. The reasoning is almost *nil*, once the essential element is seen. The significance is due to relationships, the meaning of one element in the light of others. Little creative imagination is needed, since the stock of ideas is furnished in the pieces. In the improved new test these points are made vastly clearer, the situations are more complicated and require better appreciation of the elements in each than is found in the old pictorial test.

One other type of test is interesting to compare with those for apperception—namely those where the problem is one of generalization, as in the 'multiple choice test' in various forms. Here the relationship is realized through the process of dissociation. The relationship is the one unchanging feature in a succession of experiences, all the other concomitants of which vary. The realization of the law of relationship is reached through repetition of experience. Thus generalization is here arrived at through dissociation rather than through apperception.

It is obviously not possible to attempt an analysis of all tests now in use which require apperceptive powers to some extent. In many apperception is involved, but complicated by other processes and hence difficult to disentangle. Usually it is not involved sufficiently to allow one to make any interpretation of the subject's apperceptive abilities.

There still remains a very interesting and practically important point; namely the relationship between apperceptive abilities and so-called 'general intelligence.' To what extent is an intelligence quotient diagnostic of this perhaps more specialized capacity?

A survey of the results attained on various tests by a group of 1,043 cases studied at the Judge Baker Foundation, 729 of whom are repeated offenders, shows a low correlation between Pictorial Completion Test II. score and the Stanford-Binet intelligence quotient. For twelve-year-olds the coefficient of correlation is 33, for sixteen-year-olds it is 10. For this group, then, the Terman I. Q. does not afford a measure of apperceptive ability. Furthermore, comparison of the results obtained by the selected groups with those obtained by an unselected group, tested in order to obtain age-norms, shows that delinquents as a group do not differ from an unselected group of non-delinquents sufficiently to be significant. But individual case-studies show that in instances defective apperceptions are directly related to delinquency, indeed are perhaps the main cause.

Conclusion

We have attempted to show that there is justification for considering apperception as a mental process, important to be taken into account in estimating abilities, involved frequently in other mental activities, yet distinct from them. If this is true, we need to consider which tests enable us best to study this ability. The Pictorial Completion test would seem to measure little else than apperception and hence to be a splendid means of estimating it, while the Trabue Language Scales give a measure of it but so influenced by language ability that the latter must always be taken into consideration. In cases studied at the Judge Baker Foundation, apperceptive ability as measured by Healy Pictorial Completion Test II. correlates but slightly with the intelligence quotient obtained on the Stanford-Binet Scale. This makes it all the more urgent to study by means of specialized tests the apperceptive ability of individuals since, among both the mentally normal and the defective, it represents a particularized ability that has prognostic value and important social implications.

THE MOTIVATION OF RADICALISM

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The terms reactionism, conservatism, progressivism, and radicalism are all relative, both to one another and to any given social situation or problem. It is not possible, therefore, exactly to define radicalism. In general, however, we may take radicalism as a term—originally of opprobrium, which use some interests would like to reëstablish—connotative of desire and advocacy of thorough-going innovative change of the social environment, or of some particular part of that environment which impinges upon and conditions the life of the individual in an annoying way.

Generally speaking, radicalism—the desire for and advocacy of thorough-going social innovation—is the product of unrest. Unrest is the expression of personal discomfort. Thoroughly comfortable individuals never become radicals. The main reason why people desire innovative change in social organization or process is that they are uncomfortable under the existing *status quo* and see no prospect of relief by altering their own personal situation or in reactionary modification of the environment.

Not all discomfort, even when extreme, leads to radicalism. The uncomfortable individual, annoyed by a felt maladjustment between himself and his social surroundings, may be able to relieve his discomfort and annoyance simply by shifting his own position to a different, but existing, environment. Annoyed by poverty he may by hook or crook climb out of it. Discontented with his job or vocation he may take up another. Dissatisfied with Old World opportunities he may come to the New. Restless under religious controls he may cast them off, or, on the other hand, unable to find peace and courage in rational realism, he may take refuge in religious mysticism. In other words, dsicomfort may—and in the more static social epochs, with most individuals, ordinarily does—lead either to more or less sustained and persistent attempts to shift one's self to an existing environment in which comfort can be found, or to patient, painstaking effort, in many cases successful, to discipline the self and adjust the personality to the social situation in which one happens to have been placed. Discomfort may thus lead only to individual effort purely for direct personal ends, to a contented disbelief in the efficacy of human effort, to sullen stoicism, to cynicism, or possibly to blind rage finding relief in mob violence.

Discomfort may not lead even to a mild progressivism, in any social sense. It may produce no attempt to change the environment itself even in superficial ways. In such cases we must conclude that the individual's life is so dominated by fixed habits that failure of certain aspects of his personality to obtain adjustment and healthful functioning is not sufficient stimulus to break down the inertia of his established routines and attitudes. Similarly, his social or economic position may be such that no ordinary amount of discomfort or maladjustment serves to overcome his fear. This is notably the case in certain types of what may be termed the 'conservatism of necessitous condition.' When the uncomfortable person contemplates no other method of removing his discomfort than those at the time recognized and practiced as conventionally right and proper—for example, the 'business principles' of self-help, *caveat emptor*, charging what the traffic will bear, individual energy, initiative and thrift, and the 'go get it' spirit, or the Christian virtues of modesty, humility, self-criticism, conscientious soul-searchings, and conviction of sin and unworthiness—the radical attitude does not develop, because these methods contemplate no objective environmental change.

Only when discomfort or dissatisfaction creates a desire for significant changes or transformations in social organization, relations, or standards does it lead to other than essentially habitual conservative attitudes. When the desire for thorough-going, fundamental, and rapid change of the environment in essential respects is present, the sources of this desire will always be found to be some maladjustment between the individual and his surroundings, such that he is consciously uncomfortable and restless, and such that he seeks relief not in modification of his own personality but in transformation of the external social world. It is not essential that he know the causes of his discomfort or that the objective changes he desires be such as would remove the real causes.

Desire is always a disposition to change—to do something that one is not doing, to have something that one has not, or be rid of something that one has, or to be something other than one is, or thinks one is, at the particular moment. Desire is the result of stimulus, and stimulus always leads to some sort of bodily or psycho-physical activity. The stimulus, whether from some part of the organism itself or from the external environment (physical or social), produces a disequilibrium, which is normally balanced by the appropriate reaction or response. The normal, healthy conservative lives a life of short-cycle routine (largely habitual) in which organic disequilibria, physical or mental, are balanced, and the energy of desire or unrest released in a fairly regular rhythm. In individuals who become radicals, this short-cycle ebb and flow of disequilibrium and equilibrium, of desire and satisfaction, of stimulus and releasing reaction, is broken into by desires or interests which do not find release or expression in normal rhythmic response. A state of more or less chronic unrest ensues, and may become the basis for definitely formulated desire for fundamental change in the environment.

Any impulse to action, any 'motor set,' desire, or disposition, the carrying out of which is impeded, prevented, or balked, gives rise to organic unrest, which may be merely physical, or 'spiritual.' [1] Now what happens when a desire

[1] All unrest has its physical basis. Even 'spiritual' disequilibrium may—when physiological psychology attains more adequate analytical power than it now has—be explained in physical terms, if any gain in clearness of understanding is to be had thereby. The terms physical and spiritual are here used in a somewhat popular or conventional sense. A man may be restless because, unconsciously to himself, his thyroid glands are overactive, because he is conscious of hunger, or because he wishes to solve

or an interest is balked?[1] Normally an unbalked desire is fulfilled and terminated by the appropriate motor activity, and an unimpeded interest functions in a recurring ebb-and-flow of attention and activity.[2] Fulfillment of desire or interest is accompanied by the appropriate feelings or emotions, mostly of a 'pleasurable' or satisfying character. When the interest is impeded or balked, however,—that is, when the normal motor response which would release the energy of the desire cannot take place—the emotional accompaniment is different. The energy held back is likely to go into a ferment, at least until it can find some other outlet than the one to which the desire or interest was at first directed. The central emotion of the balked disposition is 'hurt-feeling,' resentment, or anger. Accompanying emotions may also be fear, discouragement, or simply a generalized and diffused sense of uneasiness. Which emotions or emotional complexes are most in evidence will depend on the type of temperament and character.

a mathematical problem, rescue a fellow-man from suffering, or is himself suffering under a 'conviction of sin.'

[1] Throughout this article, except where the context clearly implies otherwise, the term *interest* is used with the connotation current among sociologists, rather than in the more technical psychological sense. Interests, in the sociological sense, according to Ross, are 'complexes woven of multicolored strands of desire' ('Foundations of Sociology,' 1905, p. 168) or 'certain great complexes which contribute to satisfy a number of our innate cravings' and which appeal 'to so many sides of human nature that for most men' they become objects 'of abiding concern and desire' ('Principles of Sociology,' 1920, p. 51). For variant conceptions, but with the same general connotation, see Small, 'General Sociology,' 1905, p. 433, Ward, 'Pure Sociology,' 1903, p. 108, and Ellwood, 'Sociology in Its Psychological Aspects,' 1912, p. 118. Ellwood, however, suggests that in order to avoid ambiguity it would perhaps be better to use the term only in the psychological sense. Dewey ('Interest and Effort in Education,' 1913, p. 17) says that "the root idea of the term (interest in the psychological sense) seems to be that of being engaged, engrossed or entirely taken up with some activity because of its recognized worth." An interest in the sociological sense, then, may be regarded as that in which one desires to be engaged or engrossed, at least for the time being. Objectively it is a complex of stimuli which claim the attention and the psychological interest, stimulate desires of a certain order, and afford gratification of those desires in a serial, ebb-and-flow manner. Subjectively it would seem to be the complex of desires and emotions associated with attention to these stimuli. Taking the term in this subjective sense, interest is as open to obstruction as is simple desire.

[2] This statement will hold whether the desire is a simple physical 'appetite,' an urge to intellectual activity, or an impulse to 'get in tune with the infinite.' On thinking, for instance, as motor activity, see Watson, 'Psychology from the Standpoint of a Behaviorist,' 1919, p. 15 and Ch. 9.

It should be understood that the initial anger is not due to loss of the object of the desire or failure to achieve the aims of the interest, but follows immediately in a purely reflexive manner upon the balking of the wish, or the damming up of the motor activity appropriate to the realization of the wish. The organism is 'set' for a given line of action, and when action cannot be carried out along that line the universal first impulse is toward those motor reflexes which are the manifestations of anger, in some one of its many forms, and which are classified under the general term pugnacity. One of these initial reflexes, and perhaps fundamentally the most important one in its social consequences, is the tendency to blame somebody—some *person*—as an object upon whom the angered organism, now set for combat, may make its attack.

Reflexive anger, blame, and set-for-combat are the initial, reflexive effort of the organism to prepare itself for action in a new situation involving a break in the regular routine of habit or obstruction of the carrying out of desire and interest. But anger and fear are closely associated, are perhaps but the two sides of one shield. Whether the combative impulse associated with anger, or the avoidance impulse attendant on fear shall guide and motivate subsequent activity can be foretold only if we know both the general situation and the character and temperament of the individual.

In any case the individual is confronted with the necessity of making some sort of readjustment between himself and his environment. He may attempt to accomplish this by attack upon the environment, or may elect, under the influence of fear (timidity, lack of self-confidence, etc.) to modify his desires and docilely accept whatever the situation may hold in store for the meek and non-resistant personality. If attack rather than self-repression is the chosen mode of readjustment the resulting attitude may very well be radical, although it might be reactionary. In the more intellectualistic temperaments the combative impulse may give way to curiosity and contrivance impulses, and the attack carried out not so much in militant as in workmanlike manner.

Speaking in the by and large, readjustment will take place through one of three processes—(1) repression, (2) substitution and transference, and (3) reinforcement. In the first, the obstructed desire or interest is repressed or totally suppressed. In the second, it is 'sublimated' through the substitution of other desires or interests and transfer of attention to them. In the third, attention is concentrated upon the obstructed desire and it is reinforced by the desire or determination to remove the obstructing agency. The method of readjustment obviously has important causal bearing on the psychology, and especially the motivation, of conservative and radical attitudes.

1. *Repression or Total Suppression.*—Where the readjustment is accomplished by a recession of the obstructed desire, the desire (*a*) either drops automatically out of the individual's life (that is, is completely forgotten) and retains no influence even in the unconscious, or (*b*) is suppressed—driven out of the individual's life by conscious act of will (desire to be rid of it [1]), or (*c*) apparently totally suppressed, it may in reality only be held in durance vile in the subconscious or unconscious by the 'censor,' which may be for the occasion either conscience, fear, or rational control. In case the desire is relatively superficial and unimportant, it is simply dropped and forgotten without struggle or effort, and without appreciable disturbance to the personality. Where it is of greater amplitude and intensity, involves a significant disequilibrium of energy, and is regarded as important, the individual can dismiss it from his life only by conscious specific attention and act of will, accomplishing complete suppression. In this case the individual gives the desire concentrated attention for the time being, not with the idea of its realization in spite of all impediments, but with the conscious purpose of getting rid of it once for all. It is highly important to him, but, from whatever reason, he prefers not to push for its fulfillment. His will to forgetting or suppression is really the stronger desire to avoid

[1] The stickler for strict psychoanalytical procedure may object that this is only a type of sublimation.

the disagreeable results probably involved in effort to overcome the obstacles to the realization of the original desire.

With the balked disposition totally suppressed, the individual can proceed to other interests, untroubled and unhampered by the disturbing emotions experienced at the time of the balking. The *idea* or the purpose of the desire is dismissed, and with it the desire. The energy which would have gone to its realization, had the individual been left free to carry out his purpose, is now free to be applied, without ulterior motive, and without regrets or hesitancy, to other interests which can be pursued without impediment from the existing social *status quo*. Where complete suppression takes place in this manner, and the individual turns his attention and energies to conventional interests, it is obvious that the reflexive anger and resentment attendant upon balked desire do not afford any effective impulse toward progressive or radical attitudes. In suppression of desire and acquiesence in the continued existence of the obstruction we have further light on the psychology of the easy-going flabby conservative. If, in such an individual, an incipient radical impulse does arise, it is immediately suppressed, and by reason of repetition of this suppression process the acquiescent do-nothing habit is firmly established.

The term suppression, or total suppression, is meant to signify that the desire is gone out of the personality completely—that it does not hang around in the subconscious or unconscious seeking egress into consciousness again at some favorable opportunity. Some psychologists hold that there is no such thing as total suppression of a wish while others hold that there is.[1] The psychoanalytical view is that once a desire is experienced, even though it never reach formulation in words (ideas), it is never so entirely destroyed, suppressed, or repressed that it may not return, though perhaps in disguised and symbolical form, to plague the individual. According to this view the desire is either held down in the unconscious by the main force and watchful police functioning

[1] The latter view is supported by Dunlap's somewhat caustic criticism of the psychoanalytic position, in his 'Mysticism, Freudianism, and Scientific Psychology,' 1920. See especially, pp. 46–50, 95, 105–108.

of the conscientious 'censor,' or through sublimation (the second of our above mentioned methods of readjustment) is allowed to drain off its energies in collateral, and perhaps diluted, streams of interest. If by the 'unconscious' is meant instinctive impulses which are not usually defined in idea form and which are habitually inhibited or unconsciously sublimated, or, from the behavioristic standpoint, obscure physiological processes (reflex arcs and arc-complexes) of which the individual is entirely unaware, it is reasonable enough to suppose that no desire ever occurs without leaving some trace of habituation or characterization upon the personality, some latent tendency for the obstructed reflex-complex to be carried out should opportunity and stimulus to it ever recur.

From a scientific, deterministic standpoint, indeed, some such trace of characterization must always remain. The individual is the product of all his past reactions, both releases and repressions. This is succinctly put by Watson when he concludes, in italics, that "youthful, outgrown, and partially discarded habit and instinctive systems of reaction can and possibly always do influence the functioning of our adult systems of reaction and influence to a certain extent even the possibility of our forming the new habit systems which we must reasonably be expected to form," [1] and again where, by implication accepting the psychoanalytic view, he says:

"Unquestionably the completeness with which old habits and the emotional factor connected with them which do not work are put away when the new situation is faced, tremendously modifies the type of personality each individual develops into . . . Possibly no one of us escapes unscathed through the childhood and adolescence stages. The early situations when again faced by the adult may not call out the overt infant reactions but they do not wholly lose their power to stir up the old implicit emotional activity. . . . A great many individuals have water-tight compartments

[1] 'Psychology from the Standpoint of a Behaviorist,' 1919, p. 418.

filled with old reaction systems which resist the storm and stress of adult life."[1]

While the reference here is to childhood desires and tendencies, the thought applies equally well to any desire or interest the balking of which necessitates readjustment of reaction systems.

It should be remembered, however, that the psychoanalysts' conclusions have thus far been derived almost entirely from observation of mentally pathological individuals, in which old and obstructed desires or 'complexes' have not been discarded or even effectively repressed. Had they given more attention to normal individuals it is quite possible that they would accept the idea of total suppression. In the case of normal personality, it makes little difference whether we call the process of getting rid of a desire which one does not care or dare to push against social obstruction, total suppression, or repression into the unconscious. The fact remains that so far as the individual's conscious life is concerned he does get rid of the desire and of the emotions experienced at the time of its obstruction, and that he has accomplished the riddance by a conscious exercise of will, by 'direct action,' without the conscious aid of sublimation devices. The bearing of these facts on the formation of social attitudes is that suppression, or repression, is not at all likely to produce radical attitudes.

2. *Transference and Substitution.*—The second method of readjustment is by way of what the psychoanalysts have named sublimation—the substitution of other desires or interests and the transference to them of the attention and energy which would have gone to the realization of the old desire. The term sublimation is an unfortunate one, however, since it connotes a lifting up and implies that the interests to which attention is transferred are 'higher' and more worthy than the original desire. This connotation would seem to be carried especially by transfer of attention from sex to non-sexual interests. The psychopathologists have found repressed sex or 'holophilic' [2] desires to be the most

[1] *Ibid.*, p. 416.

[2] See Frink, 'Morbid Fears and Compulsions,' 1918, pp. 4, 5.

prevalent causes of neurotic disturbances and have proceeded to cures through methods which involve essentially a release of the repressed desires from the unconscious to consciousness and their dilution or depotentiation through sublimation. Since the unconscious holophilic desires of the neurotic temperament are so often infantile complexes of an incestuous nature—instinctive hold-overs which constitute gross abnormalities in adult life—it was natural that the term sublimation, with its connotation of lifting up to a more worthy plane, should have been adopted to denote the process of transference of attention to substituted interests. But as a term applicable in the psychology of normal persons it is open to obvious and serious objection. Many men disappointed in love have taken to drink. The transfer may be from a higher, worthy desire to a lower, unworthy one. We prefer therefore to use the terms transference and substitution for the general process the psychoanalysts call sublimation. Sublimation, strictly defined, should be regarded as only a type of transference.[1]

Substitution and transference may be consciously and purposefully undertaken and directed, or may be largely an unconscious process. New interests may be created, or old interests given greater attention, with the direct and conscious purpose of 'taking the mind off' the disappointment and unrest occasioned by obstructed desire. The existence of this original desire is frankly recognized, but there is no attempt to suppress or repress it. It is simply deprived of support and is atrophied by disuse, since attention is withdrawn from it, and interest in it diminished, in proportion to the degree that they are transferred to the interest in process of substitution. The energy which would have gone into the realization of the original desire, had it not been

[1] This term, transference, is used by the psychoanalysts in a highly technical sense, practically synonymous with the 'conditioned reflex' of the behaviorists. (See Frink, *op. cit.*, pp. 192–197.) That is not good reason, however, why it should not be used for the purpose suggested in the text. There is no other term which suggests so accurately and definitely just what takes place in this second method of readjustment. Frink's term 'displacement' and Dunlap's 'drainage' mean the same thing, but do not seem to be as suggestively descriptive as 'transference.'

balked, or which might have been used in attempts (perhaps successful) at suppression or total repression, or gone into the conflicts of a disorganized personality in the event that repression proved a failure, is now switched to other tracks which gradually develop capacity to handle the whole traffic. When this stage is reached and the old desire reduced to innocuous desuetude, the process of substitution and transference is complete. The abnormal disequilibrium produced by the balking of the original desire is corrected; the personality is compensated by the new interest. The individual's energies now continue to function with unabated vigor, though in new directions and to altered objectives.

This whole process may be carried out unconsciously, and perhaps is so in the vast majority of cases. Attempts at repression may be made and fail, or prove only partially successful. The repressed desire escapes the watchfulness of the 'censor,' but in disguised or symbolic form, in which form it may, in weak temperaments, play pranks enough to bring on a neurosis, or may unconsciously be directed to new objectives which in conscious activity symbolize it and give release to it. The final results of such unconscious transference and substitution may not be essentially different from those of conscious transference; except that where the process is consciously directed, intelligence has a chance to prevent or minimize the tendency to dispersion of interests and to the dilettantism likely to attend unconscious transference.

We are now in position to note the influence of transference and substitution upon social attitudes. Whether the new interests to which the attention and the energy of the old desire are directed are of a conservative or radical nature will depend primarily upon the temperament and previous habituation of the individual. If he is of a nonresistant type, strongly motivated by fear complexes, or if he is deeply habituated to the existing general order of things—in brief, if he is a temperamental or characteristic conservative—his transference will be to substituted interests not in conflict with the existing conventional order or the main trend of sentiment in his class and locality. If in such a temperament transference does take place to radical interests it is probably a case of compensation, in the technical psychoanalytical sense. The non-resistent worm does sometimes turn, and when he turns it is likely to be with tiger-like ferocity.

If on the other hand the individual be of a more assertive and pugnacious temperament, transference is much more likely to be to radical interests. In either case the new interests, especially where the transference is unconscious, are in a measure symbolical of the balked desire, and we may accordingly, for convenience, speak of symbolical conservatism and symbolical radicalism.

This kind of conservatism is very common. A vast amount of interest in, and devotion to, conventional social and religious activities has this background and motivation. No small amount of 'social service,' in charity work, social settlements, mission work, both home and foreign, 'crusades,' and 'uplift' movements is indulged in by individuals who are unconsciously compensating for balked dispositions. This is particularly true of volunteer work, and is probably truer of women than of men. Women are by no means alone, however, in this symbolical conservatism. Checkmated in the struggle for 'success' on the commercial battleground, our male friend joins the army of back-to-the-land sentimentalists. Failing in his ambition for distinction in his field, the mediocre professional man settles down to routine work and creature comforts, and finds soothing release in an arm chair, popular magazines, an automobile and golf, and vicarious interest in the ambitions and activities of his children.[1]

It is now well recognized that much of the restlessness of modern women comes from the fact that the domestic duties of the home, under the modern small family system, and since the factory and other non-domestic agencies have taken over so much of the work which formerly had to be done in the individual household, are not sufficiently engrossing to

[1] It is commonly said that children help to keep parents young (via this vicarious interest), but there is perhaps quite as strong an influence toward hastening the oncoming of attributes of age.

occupy the attention or to give outlet for the instinct of workmanship and self-expression. This is especially the case with the woman whose children are 'married and gone.' She needs new interests to which to transfer her activities, now balked for lack of objective. Bridge and the movies are but imperfect substitutes, as any psychopathic clinic, or observation of the average highly domesticated middle class 'post-graduate mother,' will bear evidence. Consequently certain aspects of the woman movement are not so wildly radical as some short-sighted opponents suppose. It can scarcely be considered irrational radicalism to ask for such change in social conventions as will allow the postgraduate mother to transfer her now balked attention and energy to substitute interests of more social utility than the organized futility of social functions and 'literary' clubs without feeling that she is violating the accepted canons of taste and respectability.[1]

In temperaments strongly actuated by fear-complexes, desire-obstruction and transference of attention may lead to a different type of symbolical conservatism. The anger and resentment which in one form or another always accompany the balking of a wish and which usually produce the impulse to blame somebody are turned inward upon the self. The painful emotions of the obstructed desire are reinforced by self-castigation, the conviction of having made an ass of one's self, or a sense of sin. Under the impression that the desire was improper or sinful, the individual may resort to philosophical or mystical doctrines of resignation and renunciation; and in order to realize these ideals in his living he reinforces the consciousness of wrong-doing or of sin and then proceeds to the task of self-reform through repression and sublimation. The resentment which in some cases might have been directed against other persons, against the social organization or 'fate,' is turned upon the self, and the energies of the balked interest transferred to the task of reshaping the personality. Personal 'salvation' becomes a leading interest, symbolical of the obstructed desires.

[1] Cf. Anna Garland Spencer, 'Woman's Share in Social Culture,' 1913, Chapter 8.

It needs no erudite analysis to suggest that here has been the opportunity of the church, managed by conservative interests, to utilize the processes of sublimation and transference to keep restless individuals, suffering from the social and economic obstruction of legitimate desires and ambitions, from turning their baffled energies to the reform of social relations. As long as religion could be kept a matter of sense of sin and personal salvation, producing, through various types of mystical sublimation, acquiescent attitudes of resignation and contentment, it remained a powerful agent for conservative control. It is of very great significance when the church, as in America at the present time, begins to turn its attention, in part at least, to the removal of social and economic obstructions to the development of strong and symmetrical personalities. It indicates that the old process of repression and introspective transference are recognized to be inadequate to the development of the type of character demanded by the conditions of modern life. Where the church until recently encouraged the dissipation of personal energy in repression or mystical idealism and self-reform, to the practical ignoring of social and economic causation of 'sin' and misery, the more intelligent and progressive part of it now seeks to direct the transfer of balked-interest energy to channels and objectives which may prove quite the reverse of conservative.

Symbolical radicalism results from unrest and disequilibrium when the attention is transferred from impeded interests to radical movements or 'causes.' It is not essential that the movements to which the energy is transferred should be such as would, if carried through to success, remove the specific obstructions to the balked desire. The repressed energy may be placed to the service of the first radical movement which claims attention. All radical social movements aim at thorough-going change of social organization or relations in some one or more particular, and the motive to the desired change is the removal of obstruction of some kind. Hence any radical movement may take on, for the individual in question, a symbolical character. Since one cannot satisfy the original desire, although it is felt to be entirely normal and legitimate, since one realizes also that the seat of the obstruction is somewhere in the existing social *status quo*, and also perhaps believes that the specific obstacle cannot be removed, attention and energy are turned to some other type of obstruction or to generalized revolt against all and any of the elements of control in the present social system. In extreme cases this leads to the anarchistic attitude, and it summarizes some of the psychic processes of the 'working stiff' and I.W.W-ism, to whose abnormal but natural and perhaps justifiable complexes Carlton Parker and others have so strikingly and appealingly called our attention.

Symbolical radicalism, due to more or less unconscious transference of the energy of balked or repressed interests, may be found in the intellectual type of mind, but is more prevalent in emotional types. Such radicalism is likely to be superficial, emotional, lacking in settled principle, and unstable in its aim or object of attack. There may be a sort of serial transference. When one line of attack or radical project encounters difficulties and does not move rapidly toward consummation, it is given up (a wish easily balked) and the attention turned to some other project which for a time elicits equally emotional enthusiasm and serves as another temporary outlet for the energy of the balked or repressed desire. There may thus develop radical fashions and fads and a kind of lo here! lo there! radicalism, which never 'stays put' long enough on one thing to accomplish any thorough-going objective change in social organization.

3. *Reinforcement.*—The third method of readjustment consists in conscious reinforcement of obstructed desire. Instead of suppressing the balked disposition, attempting to repress it, or 'sublimating' it by transference and substitution, we make the desire a conscious, dynamic, motivating force to its own realization in spite of obstacles. This involves bringing to its support the determination to remove the obstructions and 'see the thing through,' perhaps against all odds. We put on our fighting clothes, and instead of wasting energy in repression, self-pity, split personality, or

symbolical and diffused sublimation, we proceed in militant or workmanlike manner to clear the ground for the realization of the obstructed interest. This is the central line of radical motivation and action, so far as the radical attitude is the result of balked dispositions. Where obstruction and reinforcement reaction lead to absorption in the radical movement or program designed to remove the specific obstructions, the final result may amount to a practically complete transference, for the time being, of the interest of the original desire to interest in winning the victory over the agencies which have occasioned the obstruction.

The results of such transference are different and more pointed than those likely to flow from the transferences hitherto noted. People who know what they want in the way of radical change, and why they want it, and who go about vigorously to accomplish the change, are far more likely to accomplish definite results (whether for good or ill) than those whose radicalism is of the symbolical and dilettante variety. In general, one of the main springs of progress is the aggressive reinforcement of impeded interest—the active, dynamic, and directed discontent which drives people to attack the obstructions to wish fulfillment.

Starting from personal unrest and balked desires, the analysis has led us through emotions of hurt-feeling, resentment, and anger to blame-reactions and combat attitudes, with just the suggestion that in disciplined intellectual temperaments the blame and combat attitudes give way at least in part to curiosity and workmanship impulses. The three processes by which an individual suffering from obstructed interests attains readjustment to his environment, or at least obtains a *modus vivendi* have been described as repression, substitution and transference, and reinforcement. Substitution and transference, more commonly called sublimation, are likely, as we have attempted to show, to lead to a somewhat ineffective 'symbolical radicalism.' Only the third process, reinforcement, can be depended upon to give drive and consistency to radical movements, or to make of radicalism a powerful social force.

The analysis of balked-interest motivation to radicalism could be brought to a close at this point, provided all individuals taking a radical trend sublimated or reinforced their desires in substantially similar manner. This is by no means the case, however. Without assuming that there are definable mental types, such as Giddings[1] has attempted, we think with some reason, to distinguish, it is safe to say that some persons are more emotional than others, some act with deliberation and some without it, and some have disciplined intellectual interests and controls, while others have not. Temperamental and cultural differences of these kinds will inevitably influence the *method* of sublimation or reinforcement. And the method may spell success or failure to attain the purposed end—escape from, or removal of, the obstruction to wish-fulfillment.

It would draw this article out to unreasonable length to enter upon this phase of the subject. Let it suffice to suggest (1) that the masses of men and women never attain to any consistent progressivism or radicalism because they either repress or sublimate their obstructed or errant desires, thus securing conservative adaptation to the existing environment, or remove themselves to a different environment, or reinforce their desires in an inconstant, explosive, blame-and-combat fashion; (2) that in a certain number of disciplined, yet highly emotional, temperaments, the typical reaction is reinforcement with great and constant intensity and with strong proclivity to praise and blame attitudes; (3) that these temperaments furnish most of the active leaders of radical movements; and finally, (4) that the more impersonal, scientifically analytical, but not necessarily unsympathetic intellectual individual does not often share in active leadership of radical movements or propaganda, but may nevertheless by the logic of facts and by his own objective honesty be compelled to furnish no inconsiderable aid to active radicalism. By his scientific analysis of both the personal (behavioristic) and the impersonal (institutional, genetic,

[1] F. H. Giddings, 'A Provisional Distribution of the Population of the United States into Psychological Classes.' Psychol. Rev., 1901, 8, 337–349. Also 'Readings in Descriptive and Historical Sociology,' 1906, pp. 236–239.

and mechanistic) causes of obstruction, he may chart the ground for the active radical leaders and help clear the way for the constructive efforts of the social engineer, whose province is not to fight the battles of conflicting economic or social interests, but to apply technological knowledge to the structure and organization of a better functioning social mechanism.

In all the preceding discussion the motivation of radicalism is found in the incompleteness of habituation and of acquiescence to the existing *status quo* and in the unrest and desire-obstruction which result from conflict of social interests and standards—the conflict between the tried and familiar and the novel and ideal.

We have now to raise the question whether all radical motivation is properly to be explained in terms of desire-obstruction and reinforcement, or whether there are instincts and proclivities which would produce the radical attitude even in the absence of obstruction and restrictive external controls.

That there are positive instincts which give rise to desire for innovation can not well be questioned. These include the instinct of curiosity (the tap-root of all science), the instinct of workmanship and contrivance (the root of the practical arts), and instincts of aesthetic self-expression (the root of the fine arts). There are also, in any differentiated social organization, proclivities such as imitation and emulation, sympathy and antipathy, desire for distinction, and the like, which certainly constitute impulses to innovation.

But whether these positive instinctive urges and socially aroused interests would in themselves produce the radical attitude depends somewhat on the meaning which we are to give the term radicalism. If 'radical' is a term to be applied to all desire for thorough-going innovation, it will apply to those who have such desire whether they encounter any social opposition or not. The great inventors and artists—all innovators—would then be classed as radicals. But if radicalism connotes innovative desire *opposed*, not by the difficulties involved in control of physical nature, but by social obstacles—by the conservative habituation and standpatism of other individuals or classes—socially unrestricted instincts of workmanship, contrivance, etc., would not be regarded as motives to radicalism.

This view of the matter would amount to drawing a distinction between innovative and radical desires. Innovative desire would then be called radical only when opposed. Such a distinction, while logically proper, is in fact somewhat academic because in actual life there is scarcely any innovative desire, especially desire for thorough-going and fundamental innovation, which does not all along encounter more or less social opposition in the form of conservative and reactionary obstruction. In a society without serious conflicts of narrow selfish interests, and with freedom for the functioning of the instincts of curiosity, contrivance, and aesthetic self-expression, the inventor, the artist, and the engineer would be producing enormous changes in our mode of living. The motivation to their work would be the creative impulses; and we could leave socially balked desires and obstructed interests out of the discussion. But we have no such society and are not likely soon to have it. The very existence of self-expression instincts, seeking outlet in innovation, arouses opposition and institutes that objective balking of disposition and that unrest which we have described as the main source and cause of the radical attitude.

Conservatism (or reaction) and radicalism are the opposite ends of the attitudinal spectrum. Innovation always has to contend against habituation, social sympathy and cooperation against intrenched special interest, rational construction against sentimental, dogmatic conventionalism, and courageous curiosity against fear. To all practical intent there is hardly a human interest or impulse which, if it involve any very serious innovative desire, will not encounter social opposition and become to that extent an obstructed interest.

From whatever reason, some individuals are temperamentally more inclined to innovative desires than are others. There are degrees of domination by fear and freedom from it, of originality and independence as contrasted with imitativeness and easy acceptance of authority, of habituation and refusal to become habituated. These differences of temperament appear in connection with all the great interests of life—curiosity and intellectual interests in general; workmanship, contrivance, and aesthetic expression; religious, ethical, and political interests; and acquisitive interests involving subjective standards of living, ambition, economic emulation, competition, and cooperation. Equally important temperamental differences exist with regard to motivation by egotism and sympathy, by hope, faith, loyalty, suspicion, distrust, desire for distinction, and desire for obscurity.

It is important to note that the obstructed desire of the radical may be one which has arisen from sympathy and not from any form of narrow selfishness. The mass of radicals are radical possibly primarily because of some acquisitive spirit or personal ambition—desire to raise their own standard of living; but there can be little doubt that misery loves company and that the solidarity of laboring class radicalism flows from a collective sympathy within the working classes. That there is not more dependable solidarity may be due both to deficiency in sympathy and to the hard struggle for existence, or for the retentions of living standards already won, which the workers are constantly compelled to make. The sincere radical leaders are beyond doubt men and women of broad sympathies and capacity for self-sacrifice. The life of the radical leader is not usually the type of life that an inherently selfish individual would choose.[1] On the other hand, while the current conservative allusion to self-seeking "agitators" and labor leaders sponging off the rank and file is to be taken for what it is—propaganda—it is not to be overlooked that some radical leaders do not rise above narrowly selfish and egotistic motivation.[2] And it is equally to be recognized that some intellectuals have been

[1] See, for instance, Ferrer, 'The Origin and Ideals of the Modern School,' 1913, Chapter 1.

[2] Cf., for illustration, Earnest Poole, 'The Harbor,' Chapter 8.

drawn into radical associations and movements not so much by spontaneous sympathy for the working masses as by a chance to escape the boredom of their class and to experience the interest of the novel and perhaps not quite 'respectable.' [1]

In spite of exceptions, however, it remains true that the average social radical is a man of wider, or at least of more intensive, sympathies than is the average well-to-do, contented conservative. The radical knows more from personal experience what the repressed and obstructed desires and interests of the working masses are. He is also in position to have a keener realization of the divergence which exists between social activities and the principles which are supposed to underlie them and to give them ethical support. In the socio-economic field narrowly egoistic interests are not likely to lead to a sincere radicalism, the real radicalism of principle; at most they may lead to the symbolical radicalism resulting from random transference, mentioned above. Social radicalism, while it undoubtedly and quite naturally has an admixture of motive resulting from balked ambition, is mainly the result of balked social sympathy and of reflective impatience with existing social wastes and injustices.

[1] Cf., J. S. Shapiro, 'The Revolutionary Intellectual,' *Atlantic Monthly*, June, 1920, pp. 820–830.

THE CONTROL OF ANOTHER PERSON BY OBSCURE SIGNS

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I

The experiments here reported[1] were upon a young man, a Moravian recently come to San Francisco, known publicly as Eugen de Rubini.[2]

An exhibition of his skill was first observed in private, where perhaps a score of guests were present. There, for nearly two hours, under the direction of various of the guests, he performed feats whose general character was that commonly known as muscle reading, but with an interesting variation. For while, during a brief time of 'warming up,' the subject held in his right hand the one end of a watch-chain of which the other end was held in the left hand of his guide,—the chain hanging usually very slack between their hands,—yet this chain was soon laid aside, and the procedure then was without even this mediate contact between guide and subject.

His success in finding things well hidden and in taking objects chosen in his absence and placing them in strange positions also decided upon in his absence,—feats commonly performed by contact,—led to the present experiments under conditions more favorable to precise control and appraisal. Thanks are due him for his readiness to submit to tests which must have seemed to him tedious and full of vain repetition.

[1] These experiments were planned in conference with Professor Warner Brown and Professor Edward C. Tolman. Dr. Brown, moreover, was present upon all but the last occasion of experimenting; Dr. Tolman was present throughout. The success of the experiments is as much theirs as the writer's, although he only is responsible for the conclusions here presented.

[2] For an account of certain of his European exhibitions, see Frans van Erlevoordt: 'Met den telepaat De Rubini,' *Het Leven*, Amsterdam, 14, 806 ff., June 24, 1919; Robert Sigerus: 'Der Telepath Eugen de Rubini,' *Zentralblatt für Okkultismus*, 12, pp. 21 ff. and 74 ff.

Throughout these occasions a protocol was made from lots cast by the guide in private, of the particular action to which he was silently to urge the subject; and immediately after each trial there was recorded the subject's success or failure. And thus until the completion of the trial the guide was the only person who knew the precise choice of action determined by the lots. In Series 1–4 the subject was told immediately after each single trial whether he had succeeded or failed. In Series 5–10, he was told nothing as to the outcome until the end of Series No. 10; while in Series Nos. 11 and 12, he was told at the close of each series. Particular care was taken to avoid positions where any reflection of the guide might be seen by the subject. The guide stood as nearly behind the subject as was possible while still watching the movements of the subject's hand. 'Contact' in the description that follows will mean the use of the slack watch-chain in the manner already described.

During Series 1–4, there were present, besides Dr. Brown, Dr. Tolman and the writer, the subject and his impresario or interpreter (for he himself understands and speaks our language but imperfectly) and Mr. Hillis, a graduate student well known to us. In Series 5–12, the same persons were present, except Mr. Hillis.

No. 1. Guide, S.; contact: The subject, standing before a table on which stood a brass bowl, was told that he would be mentally urged by the guide to deposit this bowl upon one or the other of two seats, to the left and right, respectively;[1] and that the special direction had been determined in each case by lot.

No. of trial	1	2	3	4	5	6	7	8	9	10
Direction intended by Guide	R	R	R	L	R	L	R	L	L	R
Direction taken by Subject[2]	*R*	*R*	*R*	*L*	*R*	*L*	*R*	*L*	R	*R*

No. 2. Guide, S.; no contact (except in trials 2 and 3): The subject stood before a table on which was a small vase and, about 15 inches farther from him, two small books, laid side by side. He was told that he might place the vase either upon the right-hand volume or the left, according as the guide mentally urged him.

[1] 'Left' and 'right,' here and throughout, indicate positions relative to the subject.

[2] Symbols in italic type indicate that the subject's action was correct; *i.e.*, corresponded to the intention of the guide.

No. of trial	1	2	3	4	5	6	7	8	9	10
Direction intended by Guide	R	L	L	R	R	R	R	L	L	L
Direction taken by Subject	L	R	R	*R*	*R*	L	L	R	R	*L*

No. 3. Guide, S.; mainly with contact (the subject occasionally dropping the chain and proceeding impulsively without it). Ten small volumes of like binding were laid side by side and so spaced that the entire row was about 6 feet long. The subject was told to open, in each trial, but one of the ten volumes, although he might feel and handle, without opening, as many of the volumes as he wished. (The position of the volume is indicated by its number from left to right. They were not numbered for the subject and the guide thought of each by its actual place.)

No. of trial	1	2	3	4	5	6	7	8	9	10
Volume intended by Guide	5	8	3	10	7	8	4	2	8	2
Volume opened by Subject	7	*8*	4	6	6	*8*	*4*	5	*8*	3

No. 4. Guide, T.; mainly with contact. Otherwise the conditions and task were as in Series 3.

No. of trial	1	2	3	4	5	6	7	8	9	10
Volume intended by Guide	8	2	10	8	4	7	2	3	8	4
Volume opened by Subject	6	*2*	9	*8*	*4*	*7*	*2*	*3*	*8*	*4*

The forty experiments of this first occasion give some indication of his skill, but throw little light upon the conditions which influence his skill.

At our second occasion of experimenting it was felt that if, in some of the series, we were careful to prevent the subject from getting help by hearing, his success would show a marked decline; for on the first occasion no special attention was given to the prevention of sounds; at times the subject and the guide were upon a heavy carpet, and again upon a hard uncarpeted floor; the sound of the feet in the two cases was, of course, noticably different. It was also of interest to discover whether the subject was capable of receiving guidance within very narrow, or only within large, differences of place.

No. 5. Guide, S.; with contact; on uncarpeted floor: The subject was required to place a metal bowl to L and R, as in Series No. 1.

No. of trial	1	2	3	4	5	6	7	8	9	10
Direction intended by Guide	R	L	L	R	R	R	L	L	R	L
Direction taken by Subject	L	*L*	*L*	*R*	L	*R*	*L*	*L*	*R*	*L*

No. 6. Guide, S.; no contact; otherwise the conditions and task were as in Series No. 5:

No. of trial	1	2	3	4	5	6	7	8	9	10
Direction intended by Guide	R	L	L	L	R	R	L	L	R	L
Direction taken by Subject	*R*	R	R	*L*	*R*	L	R	*L*	L	R

No. 7. Guide, S.; no contact: The task, the same as in Series Nos. 5 and 6. The floor covered with rugs; cotton in ears of subject, and with a heavy coating of vaseline outside of the cotton; heavy doubled woollen muffler over nose and mouth of Guide, who was now in stocking feet:

No. of trial	1	2	3	4	5	6	7	8	9	10
Direction intended by Guide	L	L	R	R	L	R	L	R	L	L
Direction taken by Subject	R	R	*R*	*R*	R	*R*	*L*	*R*	*L*	*L*

No. 8. Guide, S.; no contact. Task and conditions as in No. 7, except that the guide instead of following directly behind the subject all the while, followed him only to the table from which the bowl was taken by the subject; the guide there remained while the subject proceeded to the one or the other of the chairs upon which he placed the bowl.

No. of trial	1	2	3	4	5	6	7	8	9	10
Direction intended by Guide	L	R	R	L	R	L	L	L	L	R
Direction taken by Subject	R	*R*	*R*	*L*	*R*	*L*	*L*	R	*L*	*R*

No. 9. Guide, S.; with contact. Task and conditions as in No. 5.

No. of trial	1	2	3	4	5	6	7	8	9	10
Direction intended by Guide	L	L	L	R	L	R	R	L	R	L
Direction taken by Subject	R	*L*	R	*R*	*L*	*R*	*R*	*L*	L	*L*

No. 10. Guide, S.; no contact. Task and conditions as in No. 6.

No. of trial	1	2	3	4	5	6	7	8	9	10
Direction intended by Guide	R	R	R	L	L	L	L	L	R	R
Direction taken by Subject	*R*	*R*	*R*	*L*	*L*	*L*	*L*	R	*R*	*R*

No. 11. Guide, T.; no contact. Floor uncarpeted; no cotton, etc. in ears of subject; no muffler on guide. Ten small wooden match boxes were placed in a row running left and right, and so

spaced that the entire row was about 6 feet long. The subject was told to open, in any one trial, but one box, although he might touch and handle as many of them as he chose. (The numbers of the boxes given below indicate their positions from left to right. The boxes, however, were not visibly numbered and the guide usually thought of each by its actual place.)

No. of trial	1	2	3	4	5	6	7	8	9	10
Box intended by Guide	10	1	7	8	3	6	9	5	4	2
Box opened by Subject	9	3	6	7	4	6	5	5	3	2

No. 12. Guide, T.; no contact. Task and conditions as in No. 11, save that the ten match boxes were now placed in two parallel rows, close together, running left and right, 5 boxes in a row. The space between the rows was reduced to about half an inch, so that the ten boxes made a horizontal rectangle about 5 by 10 inches. (The numbers below indicate positions from left to right: 1–5, in the row farther from the subject; 6–10, in the row nearer him.)

No. of trial	1	2	3	4	5	6	7	8	9	10
Box intended by Guide	8	10	9	5	7	1	6	3	4	2
Box opened by Subject	6	4	5	3	2	7	6	1	5	6

The data of the experiments, brought together, are as follows:

No. of Series	No. of Experiments	Outcome to be Expected by Chance		Actual Outcome	
		Successes	Failures	Successes	Failures
1	10	5	5	9	1
2	10	5	5	3	7
3	10	1	9	4	6
4	10	1	9	8	2
5	10	5	5	8	2
6	10	5	5	4	6
7	10	5	5	7	3
8	10	5	5	8	2
9	10	5	5	7	3
10	10	5	5	9	1
11	10	1	9	3	7
12	10	1	9	1	9
Total........	120	44	76	71	49

The actual successes are thus seen to be about 1.7 times the number which would reasonably be expected were the subject relying upon pure guess-work.

The indications given by the ratio of successes attained to successes expected by chance are strengthened by the character of the failures. In their size or position these are not such as are most probable by mere coincidence. Such a fact cannot, of course, be detected in those experiments where but one position of erroneous choice is possible, as in Series 1, 2, 5–10, where the subject was limited to two lines of action; and if he went wrong, there could be no differences of degree in his mistake. But wherever different grades of failure are possible, where, for example, the error may have any one of nine different positions, and among these are differences of remoteness from the point of success (as in Series 3, 4, 11, 12) the subject chose, in 19 of the 24 cases of error, a position which, although wrong, was nevertheless nearer to the right place than is the average of all the wrong positions open to him. The subject evidently received from the guide some kind of cue which distinctly and favorably influenced his choice.

Large Versus Small Differences of Direction.—Separating those series where, other things remaining unchanged, there was in the one group of trials a wide spreading of the ten objects, and in the other a bunching of the ten, the following are the facts:

	Outcome Expected by Chance		Actual Outcome	
	Successes	Failures	Successes	Failures
Open order (Series No. 11)......	1	9	3	7
Closed order (Series No. 12)	1	9	1	9

The subject appears more successful where the movements open to his choice were widely different in their direction; he was more apt to make a wrong choice among objects close together.

Tentative Choice Versus Final Choice.—The subject repeatedly said that if he could only bring himself to obey his first impulse his success would be greater. The data throw light upon the reliability of this his conviction. For in three series a record was kept—by one of the experimenters other than the guide—of the subject's directions of movement before his final choice. In these series the final choice led to success in 12 cases, and to failure in 18. If he had, in the same series, followed the impulse which was sufficiently clear to be recorded by the observer, his successes would have been only 8 in number and his failures 22. If in including both successes and failures, we distinguish the failures according as they were more or were less near to success, we find that out of 30 choices the first choice was better than the final choice in 8 cases, and equal to the final choice in 9 cases, and worse than the final choice in 13 cases. The subject's belief that his first impulse was usually better than the one which he finally followed is not supported by the facts. The movement finally approved by him is usually better than that with which he begins.

In seeking for an explanation of his skill, it should be said at once that the subject made no claim to mind-reading in the sense that he could once and for all catch the thought of his guide and, without farther aid, go to the object of which his guide had thought. He needed, he said, to be assisted to the object as would a blind man; there must be by the guide a continual mental correction of his false movements and a corresponding assent and support to the movements that were right; his mind was receptive only to impulsions, and was, so far as possible, inattentive to what the guide might be betraying visibly or by sound; such things disturbed him. Direct observation supported his statement. The experimenters noticed that with his general audience, where they first met him, he several times requested that his guide cease giving certain visible or auditory signs that the subject was going in the right or the wrong direction. And when he was with the experimenters alone, the experiment now following a more reliable method, he gave no appearance of one alert to catch some sign by eye or ear; his eyes were wholly unfurtive; his manner, that of one receptive or dreamy rather than of one who sought to make the most of the externals of his opportunity.

And, farther, the experiments themselves bear out his own account, so far as he denies dependence upon any common or gross sensory signs.

The muscular and tactual signs, when these were present at all, were of the delicate character made by the very slight differences of tension and contact of a light chain usually quite slack. Yet these slight differences were of marked assistance to the subject. Although the comparison is obviously open to objection, since other differences than the presence or absence of contact enter into the contrasting groups, one may (after eliminating the worst sources of error) roughly say that whereas in the experiments with contact the successes attained are to those expected by chance in the ratio of 2 : 1, in those without contact the ratio is about 3 : 2.

It would also seem reasonable to conclude that, although contact was of assistance to the subject, yet, even without contact, the guide's intention had an effect upon the subject's line of action.

As to the question, what it is that guides him when there is no contact, it would appear that Rubini is not dependent upon hearing. Certain of the experimenters had been confident that he was appreciably helped by the sound of the guide's breathing, and of the lag or alacrity of his footsteps in following, and that with a reduction of these clues there would be a marked reduction in his successes. If anything, there is an increase.

The aids which he might have had from sight were not of a character that would have sufficed for ordinary skill. Throughout the experiments the guide was the only person who knew the position or object which meant success or failure. The other experimenters, when their eyes were directly upon the guide, felt no confidence that they could tell his intention except by his manner *after* the decision had been made by the subject. It seems improbable that the interpreter, who was present in all but the group of supplementary experiments, was able to interpret beforehand the intention of the guide; it seems still less probable that he was able to signal his interpretation to the subject since he was usually well behind the subject, and farther off from the subject than were the rest of us. It seems more reasonable to believe that the subject caught, in the very periphery of his visual field, something in the posture or motion of the guide, which assisted him. There were occasions when the feet and legs of the guide (when the subject looked down), or the guide's whole body (when the subject suddenly changed the direction of his facing) came into the border of the field of his view. Very conflicting shadows of the guide cast within the subject's field may also have been of help. In those experiments in which he was to take up and place a small brass bowl or a small enameled vase, it is possible that obscure reflections of the guide's posture might have helped; but the brass was tarnished and the vase was made of several variant surfaces. And his method of handling them (which commonly was to 'heft' and swing and rapidly twist the object) made it improbable that he got from these any help. Furthermore, in all the series, four in number, and comprising forty trials, in which books or wooden match boxes were used, such reflections, even the most obscure, were impossible. Direct reflections in windows or glass doors, or in the glass of pictures on the walls were carefully considered in arranging the precise location of the experiment. Since, in an occurrence difficult to explain, one must consider even improbable possibilities, such reflections at certain stages of some of the earlier experiments may have existed. But in the series numbered 5 to 12 the conditions were such as to exclude them entirely.

The fact that the subject was unwilling to be blindfolded may be taken as an indication that he depends to some appreciable extent, even though subconsciously, upon visual cues. The experimenters are not inclined to interpret this reluctance as casting doubt on the subject's *bona fides*. He has been a public exhibitor of his powers in Hungary, Holland and Java; arriving from the Orient, and beginning in San Francisco, he plans to give public exhibitions in America; he is, therefore, justly interested in showing his prowess in its success rather than its failure. His reluctance in regard to blindfolding stands in contrast to his readiness to exclude sounds, an exclusion which proved to be no check upon his successes. We may therefore assume that in those experiments where he worked without contact, visual cues of a highly elusive kind were of assistance. Tremors of the floor, faint sounds of the guide's movements—of the feet on the floor, of his arms and clothing (though the subject prescribed a fixed position for these, a prescription which we did not always observe), together with those made by changes in his breathing—these were diminished, but not excluded, by our conditions. In using any or all of these, however, there must have been great sensitiveness and great delicacy of subconscious adjustment to give him the proportion of successes attained. The experimenters each and all assume that these successes depended upon sensory cues of some sort, and not upon an immediate influence of mind upon mind. It is hoped that others will supplement the present manifestly incomplete experiments, and lay bare the nature of these sensory cues.

II

Supplementary Experiments

Fortunately it was possible to subject to actual test the conclusions just stated with hesitation. The experiments, as before, were at the home of the writer; and there were present Mr. Rubini, Dr. Tolman, Miss Morrison (our research assistant), and the writer. No interpreter came with him on this occasion; so that the fear that our earlier precautions against the possibility of his signaling might have been insufficient was here set at rest.

In this third group of experiments, Series 13–20, help from shadows and reflections, it is certain, were entirely excluded. A position for the guide and subject was carefully chosen beforehand where with the proper drawing of curtains, all lighting was low and came from the front, and the shadows of the subject were cast well behind him, while those of the guide, who stood behind the subject, were of course still farther to the rear. Pictures under glass that might reflect the guide to the subject were removed. An unglazed piece of pottery was substituted for the brass bowl. Two observers sat well to the rear where their facial expression occasionally and when no blinders were upon the subject might at most come into the very border of his vision. These 'blinders' consisted of a black bristol-board cylinder, wrapped completely around the head, cutting off the view, not only at the sides, but above and below, leaving a narrow, more or less circular visual field of about 80 degrees. In certain of the series, as will be noted, there was also used an opaque screen reaching to the floor and extending above the guide's head, surrounding him in front and on two sides and placed near the wall at his rear; and in its front was a narrow rectangular aperture just large enough for his two eyes to watch the subject's movements. There was used too a special helmet-like padding to surround and close over the subject's ears previously tight-plugged with cotton. Experiments beforehand showed that by this means the sound of a ticking clock was reduced to about 1/150 of its previous intensity. The guide's mouth and nose were muffled as in Series 7, and he stood in stocking feet on a heavy rug. The protocols in every case were drawn up privately by the guide, were kept in his inside pocket, and were consulted by him only after the subject with the guide behind him was in position to begin the trial; so that no unintended betrayals might come to the subject from the eyes, posture or movement of the guide. In all the Series 13–20, the subject and guide stood or walked on a well-carpeted floor. No chain or other means of contact was used in any of these series; nor was the subject told the outcome of any of them until the end of Series 20.

No. 13. Guide, S.; no contact. Task as in Series 5–10, to place a small piece of pottery in one of two chosen chairs forward and a few paces to left or right. Guide remained upon the spot where he stood at beginning of each trial; *i.e.*, he did not follow the subject when he moved toward the one or the other of the chairs. No blinders, no screen, no special reduction of sound.

No. of trial	1	2	3	4	5	6	7	8	9	10
Direction intended by Guide	L	R	R	L	L	R	R	R	R	L
Direction taken by Subject	*L*	*R*	*R*	R	*L*	L	*R*	L	L	R

No. 14. Guide, S.; no contact. Task and conditions as in No. 13, but with blinders on Subject.

No. of trial	1	2	3	4	5	6	7	8	9	10
Direction intended by Guide	L	L	L	R	R	R	L	R	R	R
Direction taken by Subject	*L*	R	R	*R*	L	L	*L*	L	*R*	*R*

No. 15. Guide, S.; no contact. Task and conditions as in No. 14, but with high screen surrounding Guide.

No. of trial	1	2	3	4	5	6	7	8	9	10
Direction intended by Guide	R	L	L	L	R	L	R	R	R	L
Direction taken by Subject	L	R	R	*L*	*R*	R	L	L	*R*	R

No. 16. Guide, S.; no contact. Task and conditions as in No. 13; but guide dogging the footsteps of the subject.

No. of trial	1	2	3	4	5	6	7	8	9	10
Direction intended by Guide	L	R	L	L	L	R	R	L	R	L
Direction taken by Subject	*L*	*R*	*L*	*L*	*L*	*R*	L	*L*	*R*	*L*

No. 17. Guide, S.; no contact. Task and conditions as in No. 16, but with blinders on Subject.

No. of trial	1	2	3	4	5	6	7	8	9	10
Direction intended by Guide	R	R	R	R	L	R	L	L	R	R
Direction taken by Subject	*R*	*R*	L	*R*	R	*R*	*L*	R	*R*	L

No. 18. Guide, T.; no contact. Task, to open the selected one of ten volumes laid in a row, left to right, on a couch before subject. Blinders on subject. Guide followed close behind subject.

No. of trial	1	2	3	4	5	6	7	8	9	10
Volume intended by Guide	3	3	9	8	6	5	6	10	8	2
Volume opened by Subject	8	7	4	*8*	*6*	3	7	*10*	6	1

No. 19. Guide, T.; no contact. Task and conditions as in No. 18.

No. of trial	1	2	3	4	5	6	7	8	9	10
Volume intended by Guide	5	9	7	5	6	10	9	8	7	4
Volume opened by Subject	7	8	6	4	5	9	*9*	*8*	6	2

No. 20. Guide, T.; no contact. Task as in No. 18, but with blinders, ear-plugs and ear-pads on subject. Guide muffled, in stocking feet, and fully screened.

No. of trial	1	2	3	4	5	6	7	8	9	10
Volume intended by Guide	8	3	10	6	4	6	7	2	5	2
Volume opened by Subject	9	6	8	4	1	10	5	9	4	6

The following are, in summary, the data of the original and these additional series, which now bring the total number of experiments to 200:

	No. of Exp's	Outcome to be Expected by Chance		Actual Outcome	
		Successes	Failures	Successes	Failures
Total of Series 1–12	120	44	76	71	49
Series No. 13	10	5	5	5	5
14	10	5	5	5	5
15	10	5	5	3	7
16	10	5	5	9	1
17	10	5	5	6	4
18	10	1	9	3	7
19	10	1	9	2	8
20	10	1	9	0	10
Total of Series 1–20	200	72	128	104	96

Assuming, from the evidence earlier adduced, that auditory impressions are of no great importance in Rubini's work, a fairly reliable index of the value to him of visual cues may be obtained through those experiments where the tactual features were constant.

Taking only these, and comparing the series where there were no extraordinary precautions against visual aids with the series in which such precautions were taken, the following appears in summary:

Series without Contact	Outcome to be Expected by Chance		Actual Outcome	
	Successes	Failures	Successes	Failures
Without special precautions against sight: Series 6, 7, 8, 10, 11, 13, 16, (70 trials)[1]	31	39	45	25
With special precautions against sight: Series 14, 15, 17, 18, 19, 20, (60 trials)..	18	42	19	41

From this it is clear that while Rubini can with sight and without the help of touch attain about one and a half times as many successes as chance would give, yet when all visual cues from his guide's behavior are excluded, the

[1] Series 2 and 12 are omitted because of the peculiar nature of the task; the objects of choice were here bunched, and they offered peculiar difficulties.

successes at once drop to the number expected by pure chance.[1]

These supplementary experiments, accordingly, fortify the conclusions suggested by those preceding. It was then felt that Rubini received visual aid from signs unintentionally given him by each of the persons who acted as his guide—signs which indicated whether he was approaching or was going away from the right object. These signs were exceedingly obscure, rarely evident to the experimenters watching the guide; and under the conditions of our latest experiments these signs could not have been given by movements of the shadow of the guide cast forward into the visual field of the subject. The hints seem rather to have come from fleeting glimpses of the guide's changes of place and posture caught in the very margin of vision and perhaps without any conscious intention by the subject to notice or use them. Yet upon these, when touch was excluded, his truly remarkable power seems to depend.

[1] Although the *number* of the failures is nearly what we should expect by guessing, yet when we consider their individual character, they are not what would most probably arise by chance. Confining our attention to the 25 failures in Series 18–20 (where there is the possibility of failures of different value) there are 7 which are farther removed from the correct position than is the average of all the possible choices; while 18 are nearer to success than is this average.

There remains accordingly what some might regard as a 'trace' of evidence that the guide, even with the precautions taken, influenced the subject. Still more careful and numerous experiments would be needed to determine what importance, if any, this 'trace' might have. It is perhaps significant that in Series 20, where both sight and hearing were limited more than in any other series, there were no successes, and the 10 failures have an average value (namely, 2.9 removes from success) but little less than the average value of all possible positions of choice (namely, 3.1 removes from success).

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BELIEF AS A DERIVED EMOTION

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The *psychology of belief* presents three main problems which may with advantage be sharply distinguished, though they cannot be discussed in entire separation: (1) the problem of the conditions which engender belief; (2) the nature of that state which we call holding a belief, a state which continues when the topic concerned is not present to consciousness; (3) the problem of the nature and proper classification of belief as a mode of being conscious, a quality of experience which qualifies our thinking of that in which we believe. It is the last problem that I propose chiefly to discuss in this paper, and to which I hope to suggest an answer more satisfactory than any that may be found in the books. A true answer to this should help to a fuller understanding of the other two problems. What then is the nature of that peculiar mode of being conscious which we call belief? That belief is a distinct quality of experience we realize if we compare it with our state of simple imagination of some event, or with one of doubt about it; say a past event: Did you lock the door? If you are in no way interested in the door's being locked or unlocked the question leaves you indifferent. You may perhaps imagine the door and yourself beside it turning the key; and this imagination may be qualified by neither belief nor doubt. But if you are keenly interested in the fact questioned; if, that is to say, you desire that the door be either locked or unlocked, your thinking of the act will issue in, or be qualified by, either belief or doubt.

Belief is the normal result of judgment in reply to a question of fact. But, though resulting from judgment, it is not to be identified with it—with *affirmation* or *denial;* judgment is an act; belief is an enduring state resulting from judgment. Some authors have put this mode of consciousness apart from all others as unique, separate, having nothing in common with any other. Others recognize it as a mode of feeling, or as an emotion. There is no other recognized category for it; and, as I hope to show, it is allied, both in its nature and in respect to the conditions which determine it, with a group of universally recognized emotions, modes of experience to which common speech unhesitatingly assigns the status of emotions.

I feel sure, then, that those are right who have classed belief as an emotion—Bagehot, *e.g.*, when he spoke of 'the emotion of conviction,' and James when he wrote that the emotions of belief and doubt are perfectly distinct, though perfectly indescribable in words; or when he wrote, "In its inner nature, belief . . . is a sort of feeling more allied to the emotions than to anything else" ('Principles,' p. 283, II.). But if so, what kind of an emotion is it? What is its relation to other emotions? How shall we classify it? What are its nearest relatives among the emotions? We may first enquire,—Is it a *primary emotion?* It is worthy of note in this connection that James did not attempt to apply his famous theory of the emotions to this particular case, did not attempt to point out what visceral or bodily sensations enter into the composition of belief. And we may safely suppose that, if he had done so, he would have realized that 'belief', although rightly called by him an emotion, stands apart from the primary emotions, for the explanation of which his famous theory was formulated and in respect of which it is so plausible and persuasive. For even James's ingenuity would have failed, I think, to resolve belief into any cluster of visceral or kinesthetic sensations.

If we put aside the James-Lange theory as unproven, we must still recognize that the primary emotions, the fundamental types of emotion, such as anger, fear, and disgust, which are universally recognized as such, have their characteristic bodily expressions, their specific motor attitudes of face, limbs, and trunk, and their specific visceral innervations. And we shall look in vain for any such characteristic bodily expression of belief. Accordingly, the actor has no difficulty in portraying those primary emotions; but could the most skilful actor portray the emotion of belief? What facial expression, what posture of the limbs, what respiratory, circulatory or glandular changes would aid him in this task? Would he not confess the task set him to be impossible of achievement?

It is, I think, mainly for this reason that so few psychologists have explicitly admitted belief to the class of emotions. For, though the view that the primary emotions are expressions in consciousness of the operation of primary impulses or instinctive tendencies has not yet been generally accepted, the fact that these emotions have their specific bodily expressions, specific innervations of the skeletal muscles and visceral organs, is too familiar to be overlooked, too obvious to be denied. And such bodily expression or resonance is commonly accepted, apart from all theory, as the mark, if not the essence, of an emotion.

But, though 'belief' differs from the primary emotions in this important respect, it seems to resemble them and claim membership in their class by reason of another fact. It is generally recognized that the primary emotions impell us strongly to action, or, as I prefer to say, accompany the working in us of strong impulses to action, the instinctive impulses. Now it has often been pointed out that belief seems to have a similar function, a power of impelling us to action. This is recognized by common speech in such phrases as 'the power of conviction'; 'the uplifting power of faith'; 'the strength that comes from belief,' and so on. And it has been much insisted on by some psychologists—notably Bain.

This view, that belief or conviction is a power or conative force, was implied in that old-fashioned theory of 'suggestion' according to which suggestion consisted essentially in producing a condition of 'mono-ideism,' the undisputed prevalence in consciousness of some one idea. Such an idea, being unhampered by rival ideas, it was said, is accepted with a conviction that gives it unlimited power to determine action or thought, and which, reaching its extreme in the hypnotic state, enables an idea to produce even profound organic changes in the body, such as blistering, or the mysterious but well accredited stigmata. Further study of the process of suggestion and of the so-called fixed ideas of mental pathology has shown, however, that this theory of suggestion, together with the ideo-motor theory of which it was both a product and a main support, was fallacious, that it was founded in the intellectualist error that was so widely prevalent in philosophy and psychology in the 19th century, the error of ignoring all the active or conative side of man's nature. We see now that the conative energy which in 'suggestion' was attributed to belief is really the same conative energy which establishes the belief; that the process of suggestion depends for its success on the evocation of a conative energy, and that the belief established by suggestion is an effect rather than a cause, an incident or phase in the sequence of events constituting the process of suggestion, a sequence which, like every other mental process, is sustained by some conative energy seeking its natural end. This ground for classing belief with the primary emotions is therefore fallacious.

Each primary emotion, or the instinctive impulse with which it is associated, has its natural goal or specific end toward which it strives and in the attainment of which it achieves satisfaction. But it is impossible to assign any such specific end to belief. Belief is an end in itself rather than a striving for some other end, it is a *terminus ad quem* rather than a driving power. And in so far as farther action, bodily or mental, succeeds to belief, there is nothing specific about it; for the ends towards which we strive, sustained as we say popularly by belief or faith, may be of every possible kind.

If belief is not a primary emotion, neither can it be classed with the compound emotions, such as admiration, awe, or reproach, which seem to be formed by the blending of two or more of the primary emotions. The arguments which forbid our classing it with the primaries apply here also; and there is the further objection that it is impossible to analyze it introspectively, or in any other way display it as a blend of any of the primaries. If, then, belief is an emotion, but is neither a primary emotion nor a blend of primary emotions, what sort of an emotion is it? Is there any class of emotions to which it has affinities of nature, and which it resembles in respect of the conditions by which it is engendered?

Yes, there is such a class; a group of emotions, which have been unduly neglected by psychologists, and which have only recently been brought into prominence by attempts to give some systematic account of their nature, genesis, and relations. I refer to those emotions which Mr. Shand has brought together under the head of prospective emotions of desire.[1] I do not agree altogether with Mr. Shand's treatment of this group and I would enlarge the class by adding several members not included by him. I submit that 'belief' belongs to that class of emotions which I have recently discussed under the heading, 'the derived emotions'.[2] The principal members of this class are confidence, hope, anxiety, despondency, despair, and regret. I have argued that all these 'derived' emotions are members of, or named points in, a continuously graded scale of emotional experiences which may accompany and qualify the operation of any strong desire. When such desire works towards its goal unhamperd by any thought of the possibility of failure and by the painful feeling that any such thought must bring, the emotional state is one of *confidence.* When some circumstance suggests or indicates a faint possibility of failure, the emotional state changes from *confidence* to *hope;* if the possibility of failure is more strongly indicated, *hope* changes to *anxiety*, the

[1] 'Foundations of Character.'

[2] In the new edition of my 'Social Psychology.'

whole train of activity being more strongly coloured by the painful feeling which inevitably accompanies the anticipation of failure. When the mere possibility of failure becomes a clear probability, the emotional state changes to *despondency;* and when that probability becomes a certainty, *despondency* becomes *despair.* Finally, when the failure is completely established, when the possibility of success lies wholly in the past, our attitude is no longer one of prospective desire, but becomes retrospective; we experience a thwarted and therefore painful retrospective desire, which is *regret.*[1]

It may perhaps be questioned whether we can properly regard these states as emotions; but to deny them the status of emotions would be to fly in the face of generally accepted and long established usage of language. No emotion is more generally recognized as such in common speech, or more widely celebrated and personified by the poets, than the emotion of *hope.* And if we admit *hope* to be properly regarded as an emotion, we can hardly refuse to admit to the same class those other members of this closely allied group of experiences. The attitudes and expressions of these emotions are not specific in the same way as those of the primaries and cannot be portrayed by the actor with the same precision and without ambiguity.

These emotions, then, are determined by our intellectual apprehension of the degrees of probability of the success of our efforts towards any strongly desired end. They are in no sense conative forces, as are the primary emotions. They are not, like these, causes or agents in mental process; they are rather effects, joint effects of cognitive and conative operations. The so-called energy of *hope* (or of *anxiety*, or of *despair*) is the energy of the desire whose operation the emotion qualifies.

What then is the place of *belief* among these derived emotions? I submit that *belief* is essentially the same as *confidence.* The only difference is one of intellectual plane.

[1] For a fuller statement of the relation of these emotions I refer the reader to the third supplementary chapter of my 'Social Psychology' entitled 'The Derived Emotions.'

When the plane of activity is one of practical bodily striving, we properly speak of *confidence*, if our striving is untroubled by any anticipation of failure. When our striving proceeds in similar untroubled fashion on the purely intellectual plane, as when we reason to a conclusion untroubled by the thought that a different conclusion may be true, we properly describe our emotional state as one of *belief*.

James claimed *doubt* as an emotional state no less explicitly than *belief;* and it seems to me that in this we must follow him. But, as with *belief*, he left its place among the emotions quite undetermined. I submit that *doubt* also belongs to this group of derived emotions, and that its place may be defined by saying that it stands to *anxiety* in the same relation that obtains between *belief* and *confidence;* namely, *anxiety* and *doubt* are essentially the same emotion, but experienced on the planes of practical and purely intellectual activity respectively.

It follows that these emotional states presuppose desire or conation, that they are experienced only in the course of the operation of desire or volition. This seems to be quite obviously true, in the case of *confidence* and *anxiety;* and the facts are only a little more obscure in the case of *belief* and *doubt*. Is it not true that a proposition in which we are not interested awakens neither *belief* nor *doubt?* Tell the boor that the sum of the angles of a triangle is always equal to two right angles, and he will neither believe nor doubt. He remains neutral; because he has no desire to know. The desire to know, whether it springs simply from the instinct of curiosity, or is of more complex roots and is a desire to know for the sake of some ulterior end, is the desire in which *belief* and *doubt* are rooted. *Confidence* and *anxiety* and the other derived emotions are rooted in desires for more practical ends or objects.

That efficacy, power, or energy which Bain (and which the popular mind also) attributes to *belief* is not truly a function of that emotion. Such ascription of conative energy to *belief* is illusory. When confident of attaining our goal, we concentrate our energies along the line of action that lies clear before us; and our activity is sustained by the pleasurable anticipation of success. In *anxiety* our energies are dissipated by conflict of inharmonious tendencies and depressed by the pain of anticipated failure. In the same way, when our aim is to know, when our goal is knowledge, and when our mental process reaches a conclusion with which no other knowledge stands in conflict or contradiction, we accept the conclusion with *belief;* further, when the time comes for action governed by such conclusion, we act with *confidence.* But, when our striving to know issues in two or more logically alternative conclusions, either one is entertained with *doubt*, and action in accordance with either is accompanied by *anxiety.*

That *belief* and *doubt* are rooted in our active and emotional nature was fully recognized by James, indeed, the realization of this truth was the source and taproot of all his pragmatist philosophy. "The quality of arousing emotion," he wrote, "of shaking, moving us or inciting us to action, has as much to do with our belief in an object's reality as the quality of giving pleasure or pain. . . . Speaking generally, the more a conceived object *excites* us [emotionally] the more reality it has." He wrote of the difficulty we find in suspending *belief* 'in the presence of an emotionally exciting idea.' "In untutored minds," he said, "this power does not exist. Every exciting thought in the natural man carries credence with it. To conceive with passion is *eo ipso* to affirm." Again he wrote: "Whichever represented objects give us sensations or incite our motor impulses, or arouse our hate, desire, or fear, are real enough for us."

All this teaching of James, showing dependence of *belief* on the active or conative tendencies of our nature, is entirely in harmony with the view I am putting forward. I am attempting merely to give to this doctrine a greater consistency and clarity, to fit the facts more systematically into the general psychological scheme. James's account suffered in two ways: (1) His tendency to sensationism in accordance with which he was logically committed to the impossible task of exhibiting *belief* as a cluster of sensations. (2) His oscillation between a mechanistic psychology (describing all mental life in terms of mechanical brain processes, in harmony with his sensationism) and a partial and inadequate recognition of purposive striving as a fundamental category of psychology. We must remedy these two defects, (1) by rejecting the sensationist principle, (2) by recognizing that purposive striving is the foundation of all mental life, present in all mental process. We may, then, improve and simplify James's formula by saying, "Objects that evoke in us conative energy, excite us to striving, to effort, to desire or aversion, are in so far real or accepted as real."

We thus put aside as erroneous that part of James's statement in which he says objects that excite sensation in us are believed as real. This is obviously untrue—multitudes of objects excite sensation and we remain neutral, indifferent, neither affirming nor denying them. The objects we perceive and are interested in are so perceived just because they are of a nature to appeal to, to evoke some conative tendency, some impulse to action, some desire or aversion. Primitively every such object is accepted as real. But, on the plane of perceptual activity, we do not properly say that our acceptance of the object as real involves *belief* in its reality on our part; rather we must say that we react upon it, or act in regard to it, with *confidence.* This is the *primitive confidence* of instinctive behaviour. At the level of mental activity at which instinctive impulse becomes desire or aversion, through more or less clear prevision of the natural end, desire is accompanied by *confidence* in so far as the means to the desired end are clear before the mind and desire works smoothly towards its end.

When action reaches the plane upon which we work towards our desired ends, not by aid of some merely perceived means, or means suggested to the imagination by a simple process of memory or recollection, but when we work rather by means chosen by reason, by inference, or by constructive imagination working upon the testimony of other minds, then we properly speak of *belief*, of believing the means to be the true, right, or most advantageous means for the attainment of the end we desire and strive for.

Belief that is to say is instrumental, it is the emotion which qualifies our acceptance of particular means towards a desired end; it is the emotion of *confidence* which qualifies the working of conation on the higher plane of imaginative choice of means to a desired end. We believe in the rightness of the plan or means which our intellectual operations have helped us to choose, or we doubt the adequacy of those means; just as, on the lower plane, we act with *confidence* or with *anxiety*. When I say *desire* in this connexion, I use it in the broad sense to cover *aversion* as well as desire proper. This requires a few words. It is generally recognized that desire plays a great part in determining our beliefs; this recognition is embodied in the popular saying—"the wish is father to the thought." And psychologists have dilated at length upon the degree to which, and the many subtle ways in which, our judgment is influenced by desire, especially by the desire that springs from our strong sentiments of love. It is not so generally recognized that aversion also plays a similar part in determining *belief;* but such seems to be the fact. Consider fear, the main root of most of our strong aversions. We hear a sudden noise in the stillness and solitude of night; it excites fear, and at once our imagination depicts some cause or source of the noise of a threatening or terrible aspect, a robber, or wild beast, or what not; and, just because we fear, we for the moment believe in the reality of the object we conceive. Such is the ground of superstitious beliefs, from the grave-yard ghost to hell-fire; the believers in these things believe them to be real, not because they desire them, but because they fear them and are averse from them. And it is notorious that the sentiment of hate, whose tendencies are aversions, rather than desires, can bias our judgment as strongly as love itself.

Let us turn back now to sensation as a ground of belief to which James attached so much importance. His formula runs—whatever objects give us sensations, or incite our motor impulses, or arouse our emotions, are objects of belief for us.

I propose to amend the formula by leaving out the first category—objects that give us sensations. James himself has cited types of experience which form the *experimentum crucis* in this matter, namely, certain pathological cases of the class of psychasthenia and *dementia praecox.* In these a permanent symptom is apt to be a lack of *belief* in the world of sense-perception; the patient sees, touches and hears things, he perceives his own body; but, although the physical things give him sensations (according to James's formula) they are not accepted as real; the whole physical world, including his body, seems to him unreal. Well, the ground of this is no lack of sensation, but the fact that the vital conative energies of such patients are either defective, insufficient, or are consumed by internal conflict, absorbed and used up in emotional experiences which are lived through in a purely imaginary world. That is to say, the physical world ceases to be real, to be believed in (although it continues to give sensations), when, by reason of our morbid condition, it no longer evokes our conative energies, our desires, and aversions, but leaves us emotionally indifferent and conatively unmoved.

Belief in the fullest sense is always preceded by *doubt,* deliberation, and choice of means. Such hesitation, such *doubt* brings out by contrast the full flavour of the emotion of *belief,* if and when the *doubt* is resolved, expecially if suddenly resolved.

The relations of *confidence, anxiety, doubt* and *belief* may then be stated more fully as follows: We desire a certain end and strive towards it with *confidence;* difficulties arise, the painful imagination of failure partially checks our striving, and converts *confidence* to *anxiety.* Then we begin to examine our plan of action, our means chosen for the attainment of our desired end. This brings our activity from the practical to the ideal plane, the plane of thinking out our plan; and we doubt the rightness, the adequacy, of the means we contemplate. We come to a decision in favor of one plan rather than another. This decision, this choice determined in part by reason, resolves our *doubt,* makes it give place to *belief*—we believe the one means to be the best, right, adequate or true means for the attainment of our desired end; or at least we believe the plan chosen to be the best possible, and we proceed to action in accordance with this belief. Or, if there is no immediate call for or scope for action, we rest in our *belief*, until such call for or opportunity for action arises; and then we reveal the reality of our *belief* by acting in accordance with the plan our judgment has affirmed to be the best.

On the higher intellectual plane of mental life, our plans of action are the hypotheses we choose as guides to action. A *belief* is thus an hypothesis which we hold as a guide in the line of action towards the achievement of the ends we desire and will.

Such is the nature of all scientific beliefs. The physicist's description of the physical world in which he believes is just a system of more or less consistent hypotheses; and these are so many plans by which he guides his actions, when he proceeds to further experiment.

Such also is the nature of moral belief. I believe that honesty, generosity, or justice is right. That is, I believe that the general plan of action denoted by the words, honesty, generosity, or justice, is the best plan for the attainment of the moral ends I desire. The meaning of each of these words is a plan or a scheme of action towards such ends. And if, in any particular case, I doubt whether generosity is right, it is because some other means, some other plan of action seems as likely, or more likely, to achieve the particular moral end desired, say the reform of some criminal.

Faith is *belief* distinguished by the peculiar conditions that establish and maintain it. Namely, when two alternative lines of action seem equally well adapted to lead us to the desired end, two hypotheses seem equally probable, and when we feel that we must work towards our end by one or other; then, by an act of volition, we choose the one, affirm it as the better, just because we cannot act and work towards our end effectively, without such definite adoption of some one plan. It is the product of the *will to believe*. And, like *belief* and the other derived emotions, it is not itself an energy; but the energy which works in us is the energy of our desire, augmented by explicit volition and unhampered by any conflicting tendency, any tendency to follow any rival plan of action towards our desired end. The view of the psychological status of *belief* which I have briefly sketched conforms with a thoroughly pragmatic view of belief and truth. For we accept as true those plans, those hypotheses, which we believe to be the best means towards our desired end, and which justify themselves in the course of action by leading us nearer to that end, when we follow their guidance.

HOW DO WE ACQUIRE OUR BASIC REACTIONS?

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That we have basic types of psychological behavior is not at all open to question. Every human being has a large series of deep-rooted modes of adapting himself to his surrounding stimuli, whether physical or social. Entirely clear it also appears that these fundamental types of behavior give definite character to the person who can only respond in the particular way made necessary by the possession of specific sorts of reaction systems. Furthermore, it appears that some of these basic forms of responses compose in characteristic fashion the raw materials from which are developed more complex and latterly acquired behavior of all sorts. Now because these latterly acquired and more complicated responses comprise forms of behavior which we must also term deep-seated and characteristic reactions, it is necessary to differentiate between (1) such basic forms of actions as infant behavior (*e.g.*, vocalization, whether considered as random acts or instincts) which soon become integrated into more complex responses (in this case, language), and (2) the more or less permanent or slowly changing fundamental acts as the talents, knacks or intelligences possessed by the mature person. From our observation of the functioning of the first, or what we have called the raw material type of basic responses, we can readily determine that the development of the person from a psychological standpoint consists of an integration and elaboration of previously acquired reaction systems.

Unfortunately, however, this view of the development of psychological phenomena does not meet with general acceptance, a circumstance which is owing to various conditions. Prominent among these conditions is the fact that since the development of any psychological organism may be traced back to a genuine beginning, namely, the moment of birth or perhaps earlier, we come to a point at which our behavior apparently has no antecedents, although the scientist cannot allow any break in the continuity of his data. Hence, the tradition has sprung up that the psychological organism possesses a series of powers, potencies or potentialities, called instincts, tendencies, or impulses, which manifest themselves in responses or at least are in some way involved in complex social conduct. As an accident of our cultural development it has happened that psychologists have thrown this problem of the basic character of some types of human behavior into the psychobehavioristic mold, and so our complex responses become thought of as the neuromuscular phases of mental tendencies.

Also, it appears to us that psychologists believe in "tendencies" of all sorts because they do not add to their observations of such of our intrinsic reactions as capabilities and talents any inquiry as to how we come to have them. Another ground for the belief in potencies is the fact that psychologists start with definite facts, namely animal instinct behavior, and make the unfortunate jump from the concrete responses with which animals adapt themselves to their comparatively simple surroundings, to 'tendencies' of the human being to perform all sorts of complex social behavior.

But such a solution of the problem of our basic behavior occasions enormous difficulties, fatal indeed to the very existence of psychology as a science. How can we admit any intangible forces and powers as explanations or as antecedents of even the most essential and earliest of our reactions? Besides giving up the most fundamental principle of science, namely to deal only with observable phenomena, such a procedure we believe makes use of words which serve to conceal the necessity and to reduce our ability to cope with the difficulties attaching to the interpretation of our intrinsic reactions.

In a recent article[1] the writer has endeavored to suggest some of the meshes into which we become entangled when we seek to explain human behavior in terms of innate capacities, powers, or potentialities, and further, to intimate that

[1] A Functional Interpretation of Human Instincts, Psychol. Rev., 1920, 27, p. 1.

another interpretation of our reactions is possible.[1] To a psychologist who refuses to step beyond the limits of response and stimulus it is axiomatic that all of our reactions, no matter how basic or widespread, must have a history in the actual behavior life of the person. No capacity or potentiality can be anything but an acquired reaction system which is put into operation by the stimulus through contact with which it was originally acquired. Such is the situation that exists, we submit, in all cases of our complex capacities, whether it be to think, to speak, to read, or to repair a chronometer. In the present paper the writer offers some positive suggestions concerning some of the mechanisms and conditions involved in the acquisition and operation of some forms of our constitutional psychological activity.

The Integrative Character of Psychological Reactions and Innate Responses.—The sole factual basis for the idea that much of our human and social behavior is innate lies in the integrative character itself, of our reactions. A positive fact it is, that in the development of the individual all of his behavior at any period of time must be the integration of previous actions. The point here is that no reaction system can be acquired *de novo*, that is to say, without having had some reactional basis with which to start. In plainer words, each stage of our development represents the acquisition of response systems, by means of the modification of previously acquired reaction systems and through the instrumentality of newer forms of stimulation, that is to say, through contact with new types of objects and conditions. Thus, the walking reactions of an infant can be observed to develop from simpler responses. Very soon after acquiring the primary

[1] In the article referred to the writer has used the term instinctive behavior as the name for our early acquired responses. The motive for so doing lay in the implication which the term afforded concerning the behavior basis of our early acquired reactions. But upon further reflection the term instinctive behavior appears too much like the term instinct, which meets with two types of insurmountable objection when used in connection with human behavior. Either one may assume that under the cover of the name instinctive behavior are slipped in some of the obnoxious potencies, or else one may jump to the conclusion that it refers to the comparatively simple chains of reflexes which are permanently present only in the infrahuman animals but not in the human organism.

walking reaction the infant builds up more complex locomotor responses, such as running to the call of the parents, or playmates, or fetching things when asked to bring them. Similarly the elementary sound reactions through contact with persons, become integrated into language behavior, and since the stimulating persons always belong to a particular group, the language products comprise a specific national tongue. Could we but analyze and study all or most of the stimuli factors conditioning the development of our reaction systems, and their operation when developed, we could gain a profound insight into our responses and the stimuli thereto, without invoking in any sense mystical powers and potencies.

While there is, then, a core or basis of previously possessed reaction systems in any new acquisition of behavior, we must not overlook the definite progressively adaptive character of our reactions. Our responses, with the exception of unconditioned reflexes, are developed to meet the needs of some present stimulation, and the conditioning factors of both the acquisition process and the operation of the responses themselves when acquired, are to be found in the specific surrounding conditions of the person. The human organism does not ever have in itself full blown powers or actions to make complex adjustments to intricate surroundings. All complex responses are the operation of reaction systems gradually evolved through the integration of simpler reactions. In the final analysis, or in other words at the period of birth, this core of previous activity goes back not to definite behavior segments but rather to random movements of a mobile biological being and to loosely organized and comparatively simple reflexes which we may call instinct acts.[1] The first forms of psychological behavior are very simple acts organized very gradually in the prenatal growth of the organism; these constitute the sole innate reactions of the organism and according to our way of thinking furnish a hypothetically

[1] We believe that the terms 'reflex action' and 'instinct action' should be used to differentiate between different kinds of responses, but for our present purpose, namely, the emphasis of the concrete reactional basis of all our behavior, we ignore the distinction.

inadequate basis for the belief in innate capacities and other fundamental types of reactions.

The Subtlety and Rapidity of the Process of Acquiring Reaction Systems.—Probably one of the important causes of overlooking the actual process of acquiring reaction systems is the subtlety and rapidity with which the process takes place. The fact is that the infant is constantly developing thousands upon thousands of reaction systems unobserved and uninfluenced by the parents. That this developmental process occurs unobserved is to a great extent owing to the parents being taken off their guard because of the difficulty they experience in deliberately training a child to do various things. It is of cardinal importance to notice that there are distinct differences between the deliberate training imposed upon an infant and the casual training resulting from a favorable contact with surrounding objects. The difficulties which baulk parents in the deliberate training of infants are due to obvious defects in the methods employed. All too frequently the parents cannot gauge correctly the proper time to stimulate the child to develop particular modes of behavior, or again, the parents use methods which they themselves would adopt were they learning the activity involved. Anyone carefully studying an infant as he responds in his own way to the countless objects and conditions around him must be impressed at once with the facility and the constancy with which modes of behavior are normally developed. Uninterruptedly the child takes on acts and attitudes which involve postures, facial expressions, modes of manipulating the mouth, and vocal apparatus, and numerous other reaction systems. To study a child carefully in its early contacts with its surroundings, to see him establish his likes, dislikes, and other traits of character, to watch him develop avoidance and pursuance responses means to give up permanently any theory of implanted powers. Later in his development the child takes on without any instruction the social, religious, economic, and other action characteristics of the family.

Strangely enough the tradition of implanted characteristics has prevailed in the face of an almost universal belief, correctly based in fact, that the early years of childhood are the formative years of human life. Although it is universally appreciated that the child in the early years of life acquires all sorts of behavior, it is not however sufficiently recognized how deep and fundamental in the total life of the individual this formative process actually is. The fact is that through the child's early contacts with objects and persons he not only develops the ordinary adjustmental activities and social ideas, prejudices and faiths, but also the talents or interests which constitute the permanent factors of his personality traits. It should not be at all difficult to understand how a child develops talents and fundamental interests and capacities if we only remember that such interests, talents and capacities are intensively integrated reaction systems, which are put into operation by complex stimuli situations. That an interest or a talent seems to be rather a potentiality in the person instead of some definite activity need not interfere at all with our view, since we may well agree that there is no difference in principle between a talent and our capacity to solve a problem in calculus or chess. While it is entirely true, when we say that in learning the multiplication table we acquire a *capacity* to multiply, what we actually are doing is building up reactions of responding with particular verbal or graphic acts upon receiving definite stimuli.

No less subtle and rapid on the whole is the acquisition of reaction systems by the adult person. This is observable every day when we change our positions, move to another part of the country or otherwise place ourselves under the influence of new persons, new objects and conditions. Of course, whatever changes occur in the person because of the acquisition of new reaction systems can be better observed by another individual than by the person himself. As among the most striking of such new acquisitions by the person, we might mention mannerisms and other types of socially unapproved behavior called affectation.

The Rôle of Stimuli in the Acquisition of Reactions.—As we have already indicated, the kinds and number of reaction systems which a person develops depend upon the contacts that person has with the surrounding objects and conditions; in plainer words, upon the opportunities to develop response systems. It follows that the same thing is true of the rapidity with which reaction systems are acquired. Each quality of an object, its color, shape and material, represents a possibility for the development by the person of specific reactions. The same thing is true of the various combinations of settings or backgrounds in which the objects are placed. To observe the elaborate education which an infant receives from contact with the popular contrivance known as the "Kiddie Kar" leaves one in no doubt concerning the effectiveness of objects to induce the acquisition of reaction systems.

Obviously the varieties of reactions which other persons induce in the individual are indefinitely more numerous than those induced by physical objects, although the latter are responsible for the acquisition by the person of many different kinds of reactions. That the contacts with persons result in the acquisition of a larger variety and more complex response systems is owing to the constant interstimulation between persons.

What the person does in play and work depends very directly upon all of his physical and personal stimulation. How a child plays and what are the games, are conditions which vary directly with the opportunities for such action. A person who has had no contact with certain kinds of animals will never fear or like them. We must of course take account here of the similarities between animals, for if a dog has bitten a child no doubt he would fear a wolf if one should appear before him. In the same way the similarity of the settings of two objects will generally cause us to carry our response over from one to the other. How we are influenced by our surroundings is excellently illustrated by the consideration of customs and language. Similarly, whether or not a person builds up bashfulness reactions or coöperative behavior depends entirely, we believe, upon his immediate circumstances.

Because of this great influence of surrounding stimuli it has become widely though superficially recognized that a developing child should have a satisfactory home environment. If parents habitually fume and rage at each other, the child will become irritable, and sullen, and rough in manner, while when the parents are overly gentle and too yielding the child will also become so. It is because of this peculiar influence of the stimuli upon persons that the belief has prevailed in the inheritance of 'disposition.' For instance, because a child reacts like one of the parents, for example quick temperedly and impulsively, it is popularly thought that the child directly inherited such a disposition from that parent. As a matter of fact, had circumstances and conditions been different, the child might have been influenced more by the other parent and displayed entirely different 'tendencies.' To be more explicit, it is the particular parent having the closest rapport with the child who influences the latter's action to such a degree that the child resembles that parent in all he does and says. In the adult it is the particular social and economic conditions which stimulate the person to build specific reactions, and in most instances the adult stimuli counteract those of infancy and youth and thus modify the previously acquired reaction systems.

Throughout all this discussion of the influence which stimuli have upon the development of reaction systems we must bear in mind that every human individual is in contact with many objects and many persons, also that objects and persons appear in various settings and therefore many interferences in influence are inevitable. Thus for example, it is not at all determined that a child should take on the reaction systems which the home stimuli promote. We must take into account the great influence of playmates and other people. In fact, the child who at home builds up reactions of respect for property and those who own it, may as a consequence be more influenced by the customs and traditions of the neighbors who are in greater possession of property than his own parents.

Classes of Conditioning Stimuli.—Since stimuli and responses are reciprocal phases of behavior segments, and since our behavior segments can be arranged in fairly distinct types, we may therefore distinguish between the various kinds of stimuli which condition the acquisition of response systems. Thus, we may classify stimuli as (1) physical; *i.e.*, those objects and conditions that induce reactions, but which are practically fixed and admit of relatively no interplay of stimulation because they are not affected by the person. We might assert that, in general, contact with physical stimuli result in the acquisition of all those response systems which serve to adjust the person to the innumerable physical conditions of our surroundings, as the avoidance of noxious objects, the seeking out of favorable or desirable things, and the modification of our relations to atmospheric conditions and changes. (2) Personal stimuli; persons and their actions, then, would constitute an entirely different class of stimuli. In this case, the stimulus itself being a person, in turn is stimulated by the reacting person and as a result there is an intricate interplay of effects of the stimulating and responding individuals. Through such mutual stimulation we develop the most complex and numerous behavior segments, and acquire such conduct as is popularly called fear, anger, rivalry, hate, love, desire, ambition, scorn, coöperation, admiration, gratitude, belief, credulity, envy, jealousy, etc. (3) Cultural; under this heading we place social situations, as famines, the volcanic devastations of cities, etc., and social objects or institutions. An institution we take to be any thing or condition which operates as a common stimulus to a definite group or series of individuals. Cultural stimuli may be of two types, those comprising the common reactions of members of a group, such as the institutions we call manners and customs, or they may be the products themselves of social behavior, as buildings, roads, distinct wearing apparel, etc. Through the operation of the cultural stimuli which obviously must coincide with personal stimulation[1] we build up all of the myriads of

[1] In our personal contacts we acquire what we may call individual human conduct as compared with the common reactions of convention. While we cannot draw sharp lines here we can differentiate between the aspects of our intellectual, æsthetic, moral, political, and other reactions, constituting the panoply of our personal behavior and those phases of our social conduct which we share with some or all of the other members of our particular group.

behavior types which are frequently denominated social conduct.

Enumerated among the reactions of social conduct are the political, social, æsthetic, moral, religious, and intellectual reactions which are hypostatized as sentiments, emotions and other states of consciousness. Let us be entirely clear concerning our views at this point. It is our theory that through contact with persons and institutions we acquire a very large series of behavior segments which make the reaction conditions of our everyday conduct. These social reactions are the integration products of the interplay of men and institutions and let us not for a moment overlook the fact that we are talking about actual acts, ways of eating, walking, talking, playing, etc. How many such social responses there are can never be made the subject of statistics. There are as many reactions as there are permutations of individuals, groups, and institutions in social situations. To attempt to make lists of the various social responses would mean to attempt to staticize and limit what from the nature of the case cannot be so handled. And let us not slight the fact that each name for social behavior, such as awe or shame, must, if it is to mean anything at all, stand for some concrete and specific action which of necessity is absolutely different for each person, and also varied within the different periods of an individual's life. An act of charity, mercy, faith, hope, shame, or resentment is a specific factual behavior situation and we must by no means overlook the fact that because for descriptive purposes we apply a conventional term to such reactions there is nothing but a conventional similarity in such behavior situations. What, we might ask, is common to the honor of thieves, nations, and gentlemen? Social conduct, we repeat again, consists of behavior segments developed through contact with actual institutions or common stimuli, and the nature of the behavior is a direct derivation of the stimulating circumstances in which the person acquires it.

How Stimuli Function in the Acquisition of Reactions.— On the side of the stimulating circumstances, we might arbitrarily divide the conditions which induce the development of reaction systems into two types. We do this not because there are in fact only two classes, nor because these are entirely independent modes of inducing reaction development, but rather because in such a maze of complex situations it is well if we can contrive some order no matter how provisional and inadequate. As we proceed in our discussion we shall see that the two types of mechanisms for building up response systems overlap at almost every point. Be the situation what it may, we shall attempt to classify the mechanisms of inducing reactions into two types and we shall name these types *deliberate* and *casual* respectively. By the deliberate means of inducing reactions we refer to the process in which the human individual is brought to conform to the practices and ideals of the group in which he lives by the authority of the group. On the other hand, the casual type of process is that in which the mere contact with objects and persons results in building up appropriate reaction systems. On the whole it is probably safe to say that the casual process is the most efficacious form, as the doctrine of teaching by precept would imply, and perhaps we might also add that the reaction systems built up by this process are the more fundamental factors in the make-up of the personality.[1]

A. *The Casual Stimulation Processes.*—Among the earliest of the mechanisms for building up reaction systems is the stimulation of the mother or nurse, the home objects, and the parents or other members of the family and household. Through contact with these physical, personal, and social stimuli the individual builds up those fundamental forms of behavior which are primarily responsible for his particular traits and temperament. By coming into various types of contact with the stimuli we have mentioned, the child takes on those types of reactions which make it easier for him to adapt himself to a certain kind of environment, that is, one fairly common with his own, and in consequence induce him to build up other similar reactions. If the home is provided

[1] Here, it seems to us, lies the factual basis for the Freudian and other theories of the 'Unconscious,' and the scientist's belief in instinctive or intuitive knowledge; cf. Mach, 'The Science of Mechanics,' pp. 1, 26–28, 80–83.

with objects and conditions reflecting the musical, other artistic, or entirely different kind of interests of the parents, or a single parent, then the child will build up such reaction systems which will function as those we ordinarily call talent or interest. The person will then seek stimuli of a musical or other definite sort. Just how deep and lasting these talents and interests become depends to a great extent upon the concord and unity of the home condition, in addition to how well the child fits into the home situation. It can be readily seen that the development of certain traits in the child depends directly upon the sympathetic interest of one or both parents, an interest which itself depends upon the harmony of the home conditions.

Another very striking source of casual stimulation is the contact with persons outside the home. Just how effective and effortless the casual stimulation process may be as compared with the deliberate process is readily appreciated by everybody who has acquired some art, both with and without the intentional stimulation of insistent parents. That one is in contact with various associations of persons does not mean always that the person will build up reactions of conformity, nor that the conformity which does occur will be complete. Patently, the person just as definitely, although just as unwittingly, is induced to do entirely the opposite or to accept the stimuli only in part. Just why this situation should exist is clear when we consider that the person receives stimuli from numerous individuals—individuals belonging to different and sometimes opposing groups.

The strength of the casual stimulative process depends entirely upon the agreement or harmony of the new stimulation with the old circumstances to which the person's present reaction systems must be attributed. The lack of similarity between old and new stimulating circumstances when they are social institutions paves the way for such complex phenomena as class and race prejudices of all sorts and is moreover the basis for the psychological variations between the individuals comprising different groups. For different groups are merely aggregations of individuals who have been stimulated by different institutions and who have in consequence developed different reactions.

Incidentally we have been led to the consideration of another powerful casual instrument for the building up of reaction systems, namely, institutions. As we have already observed, the presence of numerous institutions or common stimuli developed and fostered by the individuals of a given group force the person to acquire specific sorts of response systems with which to adapt himself to those institutions. The casual character of these acquisitions is readily understood from the fact that the institutions and the reactions to them appear to the person as natural facts with apparently no beginning or end. Anyone who attempts to change or remove one of these absolute institutions meets with the dire wrath of the individuals who have already built their adaptive behavior around such common stimuli. Only through an acquaintance with other and conflicting institutions can we be freed from the influence upon our behavior of the original stimuli found in our own family, nation or other group.

Another evidence of the power of casual stimulation is found in the fact that even in the supposedly most critical levels of activity, namely in the scientific domains, we also find it operating as effectively as in the most elementary situations; although scientific workers are presumed to be absolutely critical in their attitudes and to base their scientific information and judgment upon what they can determine to be actual occurrences, they are nevertheless greatly influenced by authorities and school affiliations. The stimulating circumstances responsible for this condition are the obvious complexities of facts which make it impossible for single individuals to be in actual contact with all phases of any phenomenon. Again, because our reaction systems are integrations of previously acquired responses, we have always a core of reactional foundation which influences the later development of reaction systems of the same general type.

Fashions in science and other domains of critical thought likewise exemplify the subtle influence of institutions in inducing the development of reaction systems. A study of the intellectual history of nations or of general movements of thought in various centuries indicates very clearly the modifications in ideas paralleling changes of an institutional sort in the economic and social domains of activity. No field of human endeavor is uninfluenced by the changes in institutions, and especially is this fact illustrated by the periodic modification of attitudes and ideals in art.

B. *The Deliberate Process of Stimulation.*—Much of the stock of the person's reaction systems is developed by direct operation of various deliberate agencies; so that there is a constant process of modification and integration of the adjustment mechanisms of the person. Among the earliest of the intentional stimuli for building up reactions are the training efforts of the parents. The latter not only induce the acquisition of all sorts of adaptive responses to physical objects and conditions but inspire conformities to social stimuli as well. The parents knowingly or unknowingly are themselves stimulated by the needs of the social surroundings and in consequence attempt to build up in the child all sorts of behavior which will enable the latter to adapt himself to the various objects and conditions which are the inevitable environment of persons.

What the parents in the home cannot accomplish the schools are supposed to bring about. As a general proposition the schools are presumed to induce the child to acquire mainly informational responses as a preparation for work and citizenship, but as the school institutions have developed they stimulate the acquisition of all sorts of social reaction systems. Clearly, it is impossible for the functions of the parental and school training to be very sharply sundered and so they not only supplement each other, but duplicate each other's processes.

For the more mature person a large number of institutions exist for the stimulation of reactional acquisition. We need name only a few which will bring to mind the entire process of deliberate stimulation to develop all sorts of behavior systems. The military institutions actively reconstruct the individual to the extent that anyone who passes through the course of training takes on an entirely new personality. Such a person responds differently and characteristically to all of the surrounding objects and conditions whether physical or social. Less general is the transformation of the person which the church aims to bring about, for the latter is primarily interested in the so-called moral and spiritual behavior of the person. Prominent also among the institutions which deliberately induce new and characteristic reactions in the individual are the various voluntary associations, such as fraternities, lodges, literary, social and other clubs. Each of these is designed intentionally to modify the person and his behavior in order that he will yield to definite prescriptions of social action.

Distinction between Stimulating Situations and Biological Environment.—The psychological problem of stimulus and response must not be confused with the biological problem of inheritance versus environment. Let it be understood therefore that one should not draw the conclusion from our argument that we are denying the potency of heredity in favor of the strength of the environment. Our argument, the reader will recall, assumes that the condition for any adjustment is the presence both of a stimulus object and of a reaction system for that stimulus which the person has acquired and added to his behavior equipment. Now one might properly conclude that our exposition does imply an exclusion of all immediate heredity factors in the integration of behavior, but at the same time it is necessary to observe that we exclude also the correlated biological environment. For notice that different individuals at the same moment or the same individual at different moments may be aroused to action by different stimuli in the same biological environment. The problem of inheritance and environment from our standpoint then must deal with a prepsychological factor that goes below the development of adjustment acts. In plainer words, we must distinguish here between (1) the psychological fact of an integration of an organized specific response with a particular excitant of that response, which involves no direct hereditary factor, and (2) the biological fact of a correspondence between specific organic structures with their more or less general functions such as growth and reproduction, and the ecological conditions to which they are adapted, which may and frequently does involve many direct and immediate hereditary factors.

To the largest extent the inheritance-environment problem refers to the development and continuation of biological characteristics, both functional and structural, which may be only very remotely the basis for psychological phenomena. In general, the environmental conditions of the persons as such need not necessarily be stimuli to psychological action even though they may be potent conditions for the preservation or modification of the biological characteristics of the organism. All the stimuli of the person, however, must be considered as parts of the environment of the organism, although many of them have little or no effect upon the biological changes in the individual. The environment is therefore distinguished from the psychological stimuli in that the latter are essentially conditioning phases of segments of behavior. They are the arousers to activity or the modifiers of behavior in the course of adaptation. The probability exists, however, that in the course of time, by bringing about changes in the organism, the environment may condition the activities of the person. But this situation is very different from the direct relation of stimuli and responses each of which is a reciprocal phase of a behavior segment. The biological environment is from the psychological standpoint practically a static affair, while stimuli are by nature essentially active. Warmth (tropical climatic condition) as an environmental feature of the organism's life is a constant and permanent condition, while warmth (stove) as a stimulus is an immediate inducement to specific activity.

Types of Behavior Equipment.—Because the reaction systems acquired by the individual cover the extremely wide range from elementary maintenance responses to the most elaborate creative acts, and from the most deep seated attitudes to the most critical thought, we might profit by an attempt to inject some order into the various types of behavior in our reaction equipment. From among the hundreds, yes, thousands of various types of behavior acquired by the person through contact with various objects and situations we may for illustrative purposes isolate the following:[1]

1. Adaptive Reactions.
2. Compensatory Reactions.
3. Protective Reactions.
4. Defensive Reactions.
5. Manipulative Reactions.
6. Expressive Reactions.
7. Exhibitive Reactions.
8. Approbative Reactions.
9. Recessive Reactions.
10. Accommodative Reactions.

1. *Adaptive Reactions.*—By adaptive reactions we mean to refer to the class of actions which to all appearances seem to orient the person in his surroundings, and put him in a satisfactory relationship to the objects and situations with which he comes into contact. As examples of adaptive behavior we might cite the specific reactions acquired by the infant in learning to balance himself in the upright posture or to avoid falling over objects, and the behavior of mature persons in learning to handle a new machine or to use new tools. The eating reactions of an infant are also adaptive acts, while the acquisition of social graces by more mature persons continues the process of acquiring adjustive reaction systems.

2. *Compensatory Reactions.*—Many acts there are which do not perhaps adapt the person directly to an object, but rather replace acts which would perform that office. The child who cannot ride his bicycle can compensate for the lack by pushing it. When a child cannot overcome his opponent he sticks out his tongue at him or otherwise attempts to overcome his disability. Do not the lies told by children constitute an effort to compensate for incapacities of various

[1] In such a study as this it is only fair to acknowledge the help which psychologists have received from the observations and descriptions of the development of behavior furnished by the psychiatrists. This acknowledgment, however, need not imply any sympathy for the theoretical formulations of the psychopathologists.

sorts?[1] In later stages of development an individual lacking a musical voice similar to one possessed by an admired or envied person, will compensate for this lack by acquiring acting capacities, and thus he will be able to meet what is to him a difficult situation. Many of our manners and ideals are reactions acquired as compensations for acts which we cannot, dare not, or may not do. Some complex acts which may be referred to as talent and interest, develop at first as compensations and in many cases continue to develop and become added to because they serve an increasing need to compensate for various conditions. In recent years it has become quite generally recognized that much of the play activity of infancy and childhood is developed and indulged in as compensations or substitutions for acts and objects not available. Very good examples of compensatory behavior are the activities of the person presumed to possess great competence as a scholar or business man, but who in fact is only a splendid orator, conversationalist and punster, or one who merely possesses the reactions of a 'good fellow.'

3. *Protective Reactions.*—In our various contacts with other persons we build up reaction systems to serve as protective mechanisms. In simple form these are injury-inflicting responses involving the use of the hands, the head, and the feet for striking, kicking, and otherwise resisting the attacks of others upon oneself or playthings. For more complex situations the protective responses take on more subtle forms; they may be modes of speaking, the acquisition of various sorts of information as bulwarks of protection; they comprise also various forms of agreeing with people, organizing cliques, the distribution of gifts, and a host of other kinds of action.

4. *Defensive Reactions.*—As contrasted with the protective mechanisms acquired by the individual, the defensive mechanisms are primarily modes of reducing the stimuli which we ourselves offer to the aggressive acts of others. The simplest defensive mechanisms are illustrated by hiding self and possessions, by smiling and otherwise conciliating the

[1] In this connection cf. Kempf, 'Psychopathology,' Chap. III.

hostile individual; so that by appearing friendly and unarmed one avoids stimulating an attack. In more complex stages we can place under this classification the actions which are attempts to explain and rationalize one's behavior in defending it from self and others. As defensive behavior we probably acquire many of our most intimate social act-traits, such as suavity, pretension, etc. Enlightening in this connection is the question as to how much of our political, religious, and economic heterodoxy is acquired as defense reaction against unbearable conditions and doctrines.

Also acquired among the defensive mechanisms are various negative reactions serving to soften or remove the evil effects of certain noxious objects or situations. Such defense actions are best illustrated by the abnormal blindness, deafness, paralysis and other negative responses met with in persons commonly referred to as hysterical. The acquisition of these negative responses occurs through contact with sights, sounds and need for movement which appear to overwhelm the persons concerned. Of course these negative responses are merely extreme exaggerations of everyday behavior of a similar sort. For instance in our everyday reactions we say we did not attend to a person who was disagreeable to us, when in reality we had to pay attention to him first before we could blind ourselves to or avoid him.

5. *Manipulative Reactions.*—A very general observation it is that an infant will persist in manipulating all objects that come readily to hand. So widespread is this manipulation activity and so early does it appear that most writers on instincts include a manipulation instinct in their lists. More critical observation, however, indicates that such behavior is to a considerable extent orientative activity, indulged in because of the challenging stimulation of objects. What else could happen besides the opening and closing of a hinged door? Significantly enough observations show that only manipulative objects are manipulated and that the type of manipulation depends upon the shape, the weight, and other qualities of objects. In no case do we observe any attempt to manipulate things which do not especially invite

such responses. Illustrative of manipulative reactions in adults are such random acts as toying with a pencil while conversing and the many false moves performed while learning to operate a new machine.

6. *Expressive Reactions.*—To all it must be self evident that the human individual is not merely an adaptive mechanism, but also possesses an equipment of reaction systems making for self development and self expression. As a consequence of the affective conditions induced in individuals by surrounding stimuli he imposes in various ways his personality upon surrounding objects and situations. When thus affected by surrounding conditions the person seeks out what from an adaptive standpoint might be called unnecessary but still congenial situations, and new experiences. Such pursuit of new experiences leads to behavior which may be called transformative and expressive. Among children we observe as examples of such behavior rhyming, and recounting of words heard, or the names of playmates. Not dissimilar are the very simplest expressive acts from the kind we have called manipulatory. In the more complex and social types of behavior, expressive acts are illustrated by individual mannerisms, by peculiarities of language, handwriting and preferences of all sorts which the individual has acquired. Further, the appreciation and creation of art objects and literature are modes of a positive, self-expressive action upon our surroundings, rather than mere adjustments to those surroundings.

7. *Exhibitive Reactions.*—Among the displaying or exhibitive reactions we place those which stimulate the interest, admiration or repugnance of the observer. As in all elementary behavior the reacting person is not intentionally soliciting admiration, but the mere presence of other people stimulates the individual to indulge in various forms of ostentatious behavior, to produce sounds, act parts, repeat one's own actions, mimic others, and exhibit prowess of all sorts, etc. In the more mature person the exhibitory behavior involves taking cognizance of the interests of the observing person and responding accordingly.

8. *Approbative Reactions.*—With the accumulating contacts of the person with surrounding objects and persons he develops preference reactions which later become integrated with verbal and knowledge responses, thus becoming interest and aptitude behavior. Quite accidental may be the primary development of the preference reaction, in case it is not due to some factor reaching back to the biological stock of the person as superior color or tone sensitivity. Should the first contact of the individual with certain colors throw him into relation with more or less brilliant hues or should the first contact with certain objects happen to favor certain of them because of their variety or intensity, then those favored objects may be ever after preferred. Again, these early preference responses may arise because of the affective conditions induced in the individual by various objects or because of their negative qualities, as the absence of thorns, or other injurious or pain-inflicting parts. No matter what the original influence of such particular integrations of reactions may be, the fact remains that when such integrations of reaction systems occur, then the person has a basis for interest or curiosity in particular objects and persons. The beginning of such a system of reactions begets a further pursuit and interest in similar objects with a consequent increase of the given type of reaction systems and still further pursuits of their exciting stimuli. The interest in certain objects and persons is proportionate to the knowledge and skill one has previously acquired in reacting to them.

Out of the simple preference reactions develop the complex admiration responses of the social and intellectual level of human intercourse. Thus the person acquires and expresses certain full fledged value judgments concerning books, works of art, and persons found in his surroundings. Complex as this type of behavior appears, it is still possible to trace the development of the complex admiration reactions from the simpler preference responses.

9. *Recessive Reactions.*—Just as certain types of cumulative responses condition the further pursuit of objects and persons, so the first contacts of an individual may result in a

withdrawing from and consequent lack of interest in certain stimuli. Frequently, the results are more positive and the person may shun and be very careful to avoid objects and persons, for response to whom he has no reaction systems. Lacking response systems and being unable to respond effectively, the individual may develop compensatory responses, which may amount to defamation and contempt for the other person or object.

10. *Accommodative Reactions.*—Through constant stimulation from, and reaction to other persons, individuals, from their very infancy, learn to live with others. Through actual struggles with people and through overt teaching, persons build up reactions of toleration and even actual sympathy. Of primary importance as a condition for building up sympathetic attitudes and acts are fairly common surrounding stimuli, so there can be a common personality basis for harmonious and sympathetic action. It is because of the common surroundings that among children the more usual relationship is sympathetic until they are taught either by situations as casual stimuli or by actual teaching that there are occasions for differences and conflicts.

With emphasis, we repeat that the classification of reactions that we have proposed is intended only to illustrate the fact that our complex maze of behavior may be arranged in some order. We are, therefore, far from asserting that these reactions are mutually unrelated behavior types. Rather our purpose is to apply distinguishing names to actions that are inextricably intertwined and interwoven in the total fabric of human behavior, and in fact many of which occur as factors in a single segment of behavior. Especially clear it should be made at this point that we find no basic morphological differences whatsoever between the reactions that are considered to belong to the domain of physiological psychology and those classified under the rubric of social psychology. From an adjustment standpoint our reactions are all of a piece, but of course the stimuli to, and occasions for reaction differ very markedly indeed.

How Play Illustrates the Intermingling of Behavior Types.—No better can the integration and intermingling of our various types of behavior be illustrated than in a study of that practically universal form of psychological activity called play—which activity, it is safe to say, involves all of the types of behavior which we can isolate. But first we must note how crudely all sorts of activities are confounded under the name play—a term we apply to such widely divergent activities as (1) the complex of movements representing sheer biological vitality, (2) all sorts of direct intelligent and unintelligent responses to stimuli, besides (3) a host of different socially admonished and socially sanctioned responses. Let us not forget, however, that when we do attempt to analyze and determine what behavior may strictly be called play we find that it is an indefinitely complicated congeries of distinctive forms of psychological reaction.

Because play is so intricate a complex of various forms of psychological activity it is extremely difficult to describe and very troublesome to those who wish to explain it at a stroke.

Those who conceive of human behavior as autonomous mental states, as manifestations of simple states of consciousness, or as in any sense a detached reaction, must perforce find play to be a very elusive and unaccountable phenomenon. Play is not merely a preparation for life, although it is clear that no matter under what circumstances one acquires and integrates responses they may later be used; nor is play merely a means of relieving surplus energies. Again, play is not merely a compensation for action which one is unable to perform. Rather, play activity involves all of these conditions and numerous others.[1]

It is our deep-seated conviction that play cannot be described or explained without a close and careful consideration of the specific conditions involved. For we cannot but think that there are as many differences in play as there are in work and that the differences between the various

[1] Some insight is here afforded us into the difficulties of the play theories. We wish to point out in especial that only the compensation theory seems to have a solid psychological foundation in that it is based directly upon facts of stimulus and response. The others are teleological or at best physiological.

kinds of play actions are as great, if not greater than the differences between thinking and reflex action.

Much of what is true of play is also true of such activities as modesty, charity, coöperation, imitation, bashfulness, religiousness, love, jealousy, etc. Each of these terms stands not for sharply defined, isolated types of behavior, but for hosts of interrelated reaction systems built up in complex social situations. And further, each name stands for a multiplicity of classes of adaptive behavior. We cannot too strongly urge at this point nor emphasize too forcefully that what people usually call unaccountable inherited tendencies or traits are really such complex integrative organizations of reaction systems that the simple correlations of stimuli and responses are lost sight of in the presence of the total mass of behavior.

One more point. All of the acquisitions of behavior that we have been indicating are entirely independent of the wishes or knowledge of the acquiring person. Not that the person need be unaware of his developing modes of behavior, but rather such knowledge on the part of the person is not an essential feature of the acquisitional process. The importance of this point lies in its warning not to confuse the unintentional and intentional acquisition of response systems. Clearly, there are two distinct processes here, as is illustrated by the difference in the learning of language by a native of the country in which the language is spoken, or by the mature person who deliberately undertakes to acquire it. Possibly, the term habits would more suitably symbolize the type of acquisition in which the person deliberately undertakes the development of some skill or other type of reaction.

The Integrative Basis for Dissociation.—Excellently do the pathological conditions called dissociations illustrate the integrative character of our reactions, for the possibility of the various dissociations arises precisely from the fact that the reactions of the person are integrated and organized into types and groups through contact with the various surroundings. Since the individual develops his particular reaction systems by contact with stimulating situations it seems clear enough that, since those stimulating conditions are of various sorts, he will build up systems which may be mutually inharmonious. Just how inharmonious the organizations of response systems will be must depend upon the variability in the stimulating situations. Thus the multifarious stimulating circumstances of the ordinary family would supply no striking occasion for acquiring such incompatible responses as could later result in dissociation. If, however, the family conditions are not homogeneous and orderly the personality resulting may be fertile ground for disorganization. In every case of dissociation, of course, the crisis involves the person facing an overwhelming or at least a tremendously shocking situation. What we are especially interested to point out is that the facts of multiple personality and other forms of dissociation-phenomena convincingly show us how complex reactions are integrated from simpler responses and organized personalities developed from complex systems of responses.

The Biological Basis for the Integration and Acquisition of Reaction Systems.—From the fact that the whole psychological personality is based upon a biological foundation, in that the person is always at the same time a biological organism, it is obvious that the kind of biological stock that is present will determine to a considerable degree the kind and organization of reaction systems in any individual case. If there is any serious injury of the organism, either during prenatal or postnatal development, then clearly the person will be unable to develop as complex or as effective a series of response systems as the uninjured person. Again, there may be varieties in biological stock which are observed in the form of more or less vitality in the person. If the number and kinds of reaction systems a person acquires depend upon the contacts with objects, then clearly the more active the person is the more contacts he will have with objects and persons. The writer hesitatingly suggests the query whether the 'vitality' of a person is not a direct function of the status of the glandular activities of the organism.

In general, two types of conditions influencing the acquisition of reactions are supplied by the biological character of the person. In the first place, as we have already suggested, the type of stock of the organism conditions very markedly and very directly the behavior development of the person, since of course all the capacities and accomplishments of the person depend upon the acquisition of reaction systems. Any defect in the biological stock, such as the degeneration of neural, muscular, or osseous tissue, means a defective development of the person. The same thing is true of any defect in the physiological systems, such as the respiratory, circulatory, secretory or other types of functions.

In the second place, the biological character of the organism may be considered not as the matrix for the development of the response systems, but rather as the setting or background of the contacts of the person with his stimuli. Since by far the largest number of human responses are adjustments to other persons, it is clear that the attractiveness or otherwise of the person, with respect to form, complexion, color of hair, and eyes, etc., may greatly influence his acquiring more and different types of responses. An extreme illustration of what is meant is found in the case of the foundling who because of certain pleasing anatomical characteristics is chosen from among many others, to be given the opportunity to develop a rich and varied personality. These seemingly extraneous influences of our behavior may extend to the rather intangible phases of our conduct such as the feeling reactions which we excite in other persons.

Moreover, the presence of stimuli-opportunities for the acquisition of particular types and quantities of response systems may be furthered or hindered by the biological condition of health. One may be living in the midst of absorbing athletic activities, but if one is in poor physical condition one cannot expect to partake in such activities or become an athlete.

Conclusion.—In offering these various suggestions of the ways and means by which persons develop their early fundamental and basic types of behavior, we must emphatically point out that no attempt has been made, nor could it be made, to do anything more than illustrate a principle. For the very principle which we have attempted to illustrate stands opposed to any such *a priori* procedure as the narration of how anyone has acquired response systems without having observed the process. Precisely what circumstances lead to the integration of specific reactions can only be known from a direct study of a particular individual and the surroundings in which he is found. More point there is to this suggestion when we consider that there is no determination or inevitability about our developing reaction systems. With the exception of the stimulating circumstances and the biological factors we have mentioned, the development of reactions is wholly a fortuitous process. Our position is that all psychological phenomena must be considered as involving always the two phases of stimulus and response. Under no circumstances can we admit that our reactions are the sheer unfolding of forces or processes within the person alone, uninfluenced by stimuli, which are presumed merely to set off reactions without conditioning their existence. In psychological writings this latter view is very prevalent irrespective of the fact whether the powers in the individual are conceived of as exclusively mental or physiological.

What we have attempted to do has been to point to some facts observed in a number of cases, which exemplify the law that the number and kind of reaction systems we acquire depend entirely upon the kind and frequency of stimuli with which we are in contact, plus the reaction systems previously acquired. Because we are dealing with what are essentially intricate and highly evolved adaptations to surroundings, we cannot expect to find exclusively in the person the conditions for such adaptations; rather we must seek for these conditions in the interrelationship between the persons and their surrounding stimuli. It is needless to assert, therefore, that we must not confine our study of human behavior to an exclusive analysis of its physiological phases and to the complete neglect of essential social factors.

With respect to general methods of observation psychology is exactly in the same predicament as is physics. The physicist cannot attribute the fact that water boils at a certain pressure and temperature to a power in the water; instead he has the task of accurately determining and recording the incidence of boiling, with pressure, temperature, and other observable conditions. Likewise, the psychologist must refrain from doing anything other than describe the contacts of psychological organisms with stimuli and their settings, during the variations of the organism's well-being, and finally the observer must also take account of how the organism has been affected by immediately preceding reactions. To the writer it seems that the study of psychological phenomena exclusively in terms of responses to stimuli, as we have suggested, makes possible valuable non-prejudiced descriptions of facts, in spite of the extreme difficulty of the data with which the psychologist must work.

FACT AND INFERENCE IN RAYMOND WHEELER'S DOCTRINE OF WILL AND SELF-ACTIVITY

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I.

Professor Raymond Wheeler has recently published a report of the 'experimental investigation of the process of choosing' which he carried on during 1913–1915 with highly trained observers in the Clark University laboratory. The method was adapted from that of Michotte and Prüm, but was very effectively modified. Two pictures, or else the titles of two familiar Victrola selections, were presented at each experimental sitting with the direction, "Select one (of the pictures) to hang in your room or choose which of these selections I shall play to you." [1] Each observer dictated his introspection immediately after making his choice either to the experimenter or to a stenographer. Very full excerpts from these introspections, of which there were more than a thousand, are reproduced.

The positive outcome of the study is the experimental demonstration that every phase of the experience of choosing, while varying very much in verbal and concrete imagery from observer to observer, invariably includes kinaesthetic sensations[2] even in face of the occasional instruction to choose without employing any kinaesthetic process[3] and even in the choice between such unsensational alternatives as moral principles.[4] Professor Wheeler bases on this result a theory of will which involves two related and, in the view of the present writer, highly questionable inferences: (1), first and positively, that volition consists entirely in kinaesthetic

[1] For the full text of the directions, cf. Raymond H. Wheeler, 'An Experimental Investigation of the Process of Choosing,' University of Oregon Publications, 1920, 1, No. 2, 4. All the undesignated references of this paper are to this monograph.

[2] *Op. cit.*, pp. 8, 49 *seq. et passim.*

[3] *Op. cit.*, pp. 40 ff.

[4] *Op. cit.*, pp. 44 f.

sensations;[1] that consequently (2) volition is not rightly described as self-activity.

It is clear, at the outset, that the conclusion, 'choice consists in kinaesthetic and organic sensation' does not follow inevitably from the discovery that choice always contains kinaesthetic consciousness. For to say that x always *involves* or *contains* y is certainly different from saying that x *consists in*, or is *constituted by*, y. Thus, cake always contains flour but does not consist in flour; water always contains oxygen but does not consist in oxygen; and (to make use of a closer analogy) a poem contains letters but does not consist in letters. Similarly volition, though certainly containing kinaesthetic consciousness, need not, for that reason, consist in the awareness of throat or neck or diaphragm sensations. Thus, the persistence of kinaesthetic consciousness in the widely varying choices of Wheeler's subjects at best proves merely that kinaesthetic sensations of some sort are invariably present in volition and falls far short of demonstrating that volition is no more than kinaesthetic consciousness.

Wheeler, however, supports his identification of will with kinaesthetic sensation by another important consideration, the failure of his subjects in their introspection to report the occurrence either of a consciousness of self or of the experience of mental activity. The discussion of this second and negative part of Wheeler's theory of will constitutes the main topic of this paper. All his observers, Dr. Wheeler says: "agreed that, in their most genuine and difficult acts of choosing, such experiences as might be termed 'feelings of mental activity,' 'immediate consciousness of the self,' 'elemental awareness of the self,' 'consciousness of willing,' etc., could be analyzed into organic and kinaesthetic processes, with occasional visual, auditory, or verbal accompaniments." And this negative testimony merits acceptance, Wheeler argues, since his observers were "familiar with the conception of will as involving mental activity or self"; and since their introspections were more "detailed and carefully given" than any which Professor Wheeler (and for that

[1] *Op. cit.*, *passim*, Cf. Wheeler, R. H., 'Theories of the Will and Kinaesthetic Sensations,' Psychol. Rev., 1920, 27, p. 359.

matter, the writer of this review) has elsewhere found. Hence, Dr. Wheeler concludes: "In a voluntary choice there is no consciousness of activity as such, no awareness of an immediate and unanalyzable 'self' (p. 51[4])."

This result, however, as Wheeler does not fail to note, is precisely opposed to that of other investigations, both experimental and purely introspective, in particular to those of Michotte and Prüm, Ach, Barrett, Meumann and Calkins. These students of volition agree with Wheeler in that they find kinaesthetic and organic sensations in volition. They differ from him however in that they find in addition (1) a "consciousness of activity . . . absolutely different from the feeling of muscular activity" and, (2) involved in this consciousness of activity, an awareness of the self which is active, the consciousness that "it was I who acted." [1]

This blank opposition of careful investigators seems to augur ill, it may be noted, for the future of the very method of introspection which Wheeler employs. For who is to decide whether Michotte and Ach, biased by one set of preconceptions, have inadequately analyzed the awareness of self-activity, or whether Wheeler, biased in another direction, has failed to recognize his kinaesthetic sensations as themselves constituents of a consciousness of active self? He is, of course, "firmly convinced that the 'feeling of mental activity'" described by Ach and by Michotte is a "complex of kinaesthetic sensations" in spite of their explicit denial of this identification. And he elsewhere suggests the possibility "that Meumann's consciousness of the self in the acceptance of a task" is an interpretation "unwittingly based upon an immediately experienced but complex and diffuse kinaesthetic background and nothing else."[2] But, once more, who can be sure that it is not Wheeler rather than Michotte or Ach who is unwittingly misinterpreting the facts of experience? In this perplexity one must, of course, turn from the state-

[1] Michotte et Prüm, *op. cit.*, pp. 194, 189. Cf. N. Ach, 'Ueber den Willensakt und das Temperament,' pp. 240 *et al.*, on the *Betätigung* in which will consists, as distinguished from the perceptual phase (*das anschauliche Moment*, p. 238) of will. In this activity, Ach holds, the *Ichseite* is prominent.

[2] Wheeler, R. H., 'Theories of the Will,' *loc. cit.*, p. 358[3].

ments of conclusions to the records of the facts on which the conclusions are based, in this case, to the reported introspections of observers. The following pages bring together at least one representative quotation from each of the observers whom Wheeler quotes and the comment of Wheeler on the position of each of these observers as regards the consciousness of self-activity in volition. Special effort has been made to select full and representative accounts of the sensational experiences reported.

II.

Introspections of Wheeler's Observers

Observer A[1]

(*a*) *Introspection of A* (pp. 5 f.):[2] "When the experimenter announced that he was going to give me primitive music, I had the vocal-motor-auditory: 'Oh! Primitive music; (I)[3] like primitive music; choose (the) one (I) prefer; (the) don't want either (alternative) won't happen.' This was followed by the vocal-motor-auditory: 'Probably don't know either; good, (I am) interested in primitive music; hurry up and present them to me."

(*b*) *Wheeler's estimate of A's introspections* (p. 31[3]): "Neither *D* nor *A* are conscious of the self or of a feeling of activity during the act of choosing. . . . Both stated, upon questioning, that they were conscious of themselves or of mental activity after the final decision had taken place and relaxation had occurred, but agreed that this awareness was merely retrospective and interpretative, . . . suggested by [the experimenter's] questions and . . . not characteristic of their acts of choosing."

Observer B

(*c*) *Introspection of B* (pp. 9[4] f.): . . . "Then there was a brief period of suspense characterized by muscular strains about the shoulders, brows, mouth, and eyes and by a vocal-motor self-

[1] "The observers," Professor Wheeler says (p. 4), "who took part in this investigation were all trained introspectors. . . . They included Professor John W. Baird, Assistant Professor Samuel W. Fernberger, Drs. S. C. Fisher, Ivy G. Campbell, Florence Mateer, George S. Snoddy, Harold R. Crosland, F. J. O'Brien, and the writer." Wheeler quotes from the reports of six of these nine observers—he does not tell us from which six.

[2] For similar introspections of *A*, cf. pp. 12[2], 41[2].

[3] Parentheses denote the observer's 'own interpretation of his experiences.'

questioning: 'What am I to do? What do I know about the Rondo selection?' Then I had a vague and fleeting visual consciousness. . . . I then had the vocal-motor-auditory: 'I always prefer a vocal selection.'"

(*d*) *Wheeler's estimate of B* (p. 30): "*B* was never conscious in elemental fashion either of the self or of a feeling of activity. He found that the rapidity with which his attention shifted from one process to another, together with a background of kinaesthetic and organic processes, referred to circulation and respiration, were the basis of any tendency to interpret his experiences as feeling of activity."

Observer C

(*e*) *Introspection of C* (p. 11[2]): "I then perceived the name 'Caruso' and . . . had auditory imagery of Caruso's voice. . . . These processes were accompanied by a mass of organic and kinaesthetic contents, of muscular tensions, sensations from respiratory and apparently circulatory changes, all of which meant to me a feeling of excitement; I tended to straighten up in my chair; . . . the kinaesthetic and organic processes increased in their intensity and scope and were accompanied by marked pleasant affective toning [These experiences were interpreted by the reagent as a tendency to choose the 'Rusticana' title].[1] My glance then fell again upon the 'Mad Scene' title and the visual and auditory imagery which I had had before now reappeared, together with a similar organic and kinaesthetic complex . . . (All this meant to me that I was equally fond of both selections). Then I was aware of the vocal-motor-auditory: 'Which one of these shall I hear?'"

(*f*) *Wheeler's estimate of C* (pp. 29[4] f.): "*C* was frequently aware of himself in the act of choosing . . . but as with *J* it was always present to consciousness, not in elemental terms, but in terms of kinaesthetic sensations and images. . . . This consciousness together with an awareness of organic . . . processes gave to the reagent's consciousness complex states which he interpreted as 'feelings of activity, exhilaration, excitement' and the like. But here as before 'feelings of activity' or any 'awareness of the self' as such were not immediate experiences but interpretative and retrospective experiences, entirely."

Observer D

(*g*) *D's introspection* (p. 17[2]): "I first perceived the 'Evening Star' title and . . . repeated each word in auditory imagery.

[1] The brackets enclose comment made by Wheeler.

This was accompanied by a rapid onset of pleasantness together with a feeling of familiarity. . . . I then read the other title and very much the same series of experiences developed; then followed the vocal-motor: 'Well, both are good; both poetic; which do I want? This is going to be a difficult choice. . . .' For a short time I was aware of strains about the jaws, eyes, and in the throat; then followed the verbal process: 'Now let me see the first title again.' I turned to the upper card; I read it over carefully and came to the name, Wagner . . . ; then I was aware of a kinaesthetic 'jerk' . . . ; I noted kinaesthetic tensions and incipient movements of leaning forward, slightly; . . . at this juncture appeared the verbal process: 'Well, I know this is good; better take the one you are certain of'; this was accompanied by marked pleasantness. I then turned to the experimenter and said 'I will take this one.' "

(*h*) *For Wheeler's estimate*, see his estimate of *A*.

Observer E

(*j*) *Introspection of E* (pp. 15^2 f.): "I first perceived the 'Barcarolle' title. . . . I had 'tingling' sensations which seemed to be distributed over my entire body and . . . visual imagery of a red phonograph record and . . . of myself seated before the phonograph. . . . The feeling tone, the kinaesthetic and tactual sensations of bodily 'tingling' increased and I found myself saying in verbal imagery: 'I want to hear this one.' . . . Then I asked myself in vocal-motor-auditory imagery: 'Do I really want to hear this?' and the answer to this question was a 'welling-up' of pleasantness, of tensions in the throat, arms, chest, a sensation of warmth referred to the region of the diaphragm and faint visual imagery of the phonograph. All this meant to me an 'adjustment' to hear the selection. Then I had the verbal process 'Why do you want to hear this?' . . . I was then conscious that I seemed to be in the act of choosing the 'Barcarolle' title."

(*k*) *Wheeler's estimate of E* (pp. 30^3, 25^2): "*E* agreed with our other observers in reporting no elemental awareness of the self or of 'mental activity' in the act of choosing. . . . *E* very seldom experienced a final decision or a vigorous tendency to choose which he did not delay by the self-questioning: 'Do I really want to hear this?' 'Why do I want this alternative?' and then he would recall the nature of his previous tendencies to choose by 'living them over' in attenuated or telescoped fashion; he would compare their relative intensity and complexity, the result of which invariably consisted of an 'onrush' of the 'flux' of kinaesthetic and organic processes which had constituted these initial tendencies, and a 'reflex' shift of attention to the experimenter, together with an announcement of the choice."

Observer F

(*l*) *Introspection of F* (p. 42[2]): "After reading the two titles I had vocal-motor imagery: 'Which of these do I want?' For some time I found myself in a semi-relaxed condition which seemed to be a state of waiting or of expectancy for visual or motor imagery to appear."

No estimate of F, by Wheeler, which bears on the topic of discussion.

Observer J

Introspections of J (*m*, pp. 17[3] f.): " . . . While all this was happening I was also aware of a very rich and complex motor and organic reaction, consisting of sensations from circulatory changes, respiratory changes, sensations of pressure and hollowness from the region of the stomach and diaphragm, of tensions in the throat and chest. (All this meant to me that I was tending to choose the 'Rondo' selection and also indicated a great fondness for this particular selection.)"

(*n*, pp. 12[3] f. Description of the choice between Mendelssohn's "Oh for the Wings of a Dove" and Beethoven's "Moonlight Sonata"): "My bodily self, the title, the space between me and the title were for an instant thrown into a complex kinaesthetic and visual *schema;* this represented to me that I was . . . in the act of 'accepting' this title as my choice. As these processes were being thrown into this schema, I was aware of a long, drawn-out, breathy, auditory: 'Oh, I want this.'" [Later on in this same introspection (p. 14), *J* became aware that he was not "consciously fulfilling the *Aufgabe;* this," he adds, "was present in terms of kinaesthetic imagery of leaning forward slightly, of drooping the shoulders, and of the vocal-motor: 'What a fool to choose anything without a reason!' "]

Wheeler's estimates of J (*o*, p. 29[2]): "In the more vigorous choices *J* always found that his consciousness of the self and his awareness of 'willing' could be analyzed into complexes of experiences [kinaesthetic and organic sensations and . . . pleasantness] as stated above."

(*p*, pp. 24^2–25^1): "When these various processes [kinaesthetic, organic, etc.] reached their maximal intensity or complexity *J* was always aware of himself in the experimental situation and he invariably interpreted this awareness as 'an attitude of acceptance' or as 'an acceptance of the alternative.' . . . He seldom imposed upon himself the subsidiary task to compare the two alternatives unless the choice was unusually long and difficult; his final decision consisted of a complex motor and organic reaction. . . . "

III.

Unquestionably these introspections show, as Wheeler has insisted, the invariable presence of kinaesthetic and organic sensation in volitions of every type. The question is: do they also indicate the occurrence of a 'feeling of activity' and of an awareness of self? As to the first point, occasional phrases seem to suggest the presence, in addition to the kinaesthetic consciousness, of a 'feeling of activity.' So, Wheeler says of *B* that certain of his "kinaesthetic and organic processes . . . were the basis of any tendency to interpret[1] his experiences as feeling of activity" (p. 30) and of *C*, similarly, that he 'interpreted'[1] certain complex sensational states as "'feelings of activity, exhilaration, excitement' and the like (*f*,[2] p. 29^4)."

Little stress, however, should be laid upon these relatively infrequent and perhaps ambiguous suggestions of a 'feeling of activity' on the part of Wheeler's observers. On the other hand, it cannot be doubted that four of these six observers often have an experience which they all, and often the experimenter also, call consciousness, or awareness, of self (not specifically designated as active self). The introspectors' records teem with such expressions as "I want,"[3] "I was fond of,"[4] "I asked myself,"[5] "My state of suspense and helplessness."[6] There is frequent reference also to the "I" which is "aware of motor and organic reaction."[7] In the face

[1] Cf. page 372, below.

[2] This letter refers to Wheeler's estimate of *C*, quoted above. In the paragraphs which follow the same method of reference is used.

[3] Pp. 17^2, 25^2, *et al.*

[4] P. 11^2.

[5] Pp. 16 *et al.*

[6] Pp. 12^2 *et al.*

[7] Pp. 18 *et al.*

of all these expressions, Wheeler none the less denies, as has appeared, that his observers actually have an experience of self. The purpose of the following pages is the critical scrutiny of the reasons he gives for this denial.

In the case of two of his observers (*A* and *D*) Wheeler dismisses the alleged awareness of self as a case of mere retrospection, or interpretation. "Both *A* and *D* agreed," he says, "that this awareness was merely retrospective and interpretative and that under these latter conditions the awareness was one which the experimenter suggested by his questions and was not one which was characteristic of their acts of choosing (*b*, p. 31[3])." It follows, Wheeler infers, that the immediately realized choosing, which in these introspections *A* and *D* were recalling, did not contain any consciousness of self. But this deduction obviously overlooks a second possible conclusion. Though *A* and *D* may indeed have added, in the retrospective consciousness of choices immediately past, something which did not occur at all in the original choosing, yet they may equally well have brought to light in their introspection that of which in the direct experience they were inattentively conscious. This indeed is the recognized function of recall in introspection. Similarly, the questioning of an experimenter may, at least conceivably, serve not to suggest an experience which did not occur but to bring to mind one which did. The fact then that *A* and *D* described their consciousness of self as introspective and interpretative, attributing it to the experimenter's questions, can not prove, even if it suggests, that the self-awareness was not present in the original experience of choosing. Still less is the fact that *A* and *D* were retrospectively and interpretatively aware of self a reason for denying *in toto* the consciousness of self. For retrospecting and interpreting are themselves forms of consciousness. Whether or not, then, *A* and *D*, *in choosing* this or that picture or musical selection, were conscious of self, admittedly *in recalling* or interpreting this decision each had self-awareness.

It may be pointed out parenthetically that Wheeler's objection to the interpretative procedure seems to be purely to interpretation in terms of self. He accepts, for example, a reagent's interpretation of an experience made up of kinaesthetic and organic sensation with pleasant affective toning "as a tendency to choose the 'Rusticana' title (*e*, p. 11[2])." But if kinaesthetic sensation may properly be interpreted as choice, it seems at least equally proper to interpret as self awareness such a verbal reaction as, for example, "I am in the act of accepting."

It is however unnecessary to protest further against Wheeler's conclusion that *A*'s and *D*'s reported awareness of self, because interpretative and retrospective, has no evidential value. For two other observers, *C* and *J*, assert unequivocally that they are frequently aware of self not retrospectively but in the act of choosing. Wheeler, however, insists, and on occasion both *C* and *J* agree, that this alleged consciousness of self or of self-activity is completely reducible to sensational experience mainly kinaesthetic and organic, that it is "always present to consciousness in terms of kinaesthetic sensations (p. 29[4])." So, observer *E* says: "I was aware of an attitude of doubt or hesitation; this *consisted of* very unpleasant affective toning of tendencies to frown, to close my eyes . . . ."[1] And *J*'s consciousness that he was not fulfilling a task "was present in terms of kinaesthetic imagery (*n*, p. 14)."

The issue is clean-cut. Are Wheeler and, at times, his observers justified in reducing to entirely sensational complexes the experiences reported in terms of self? Or do the phrases, "I am aware of myself," "I find myself," "I impose on myself," "I choose," and the rest, indicate a distinctive experience, inattentively realized, unreflectively reported and sometimes even formally disavowed by the introspecters? Can we, in other words, find in the introspections proof or suggestion that experimenter and observers alike, biased by a sensationalistic theory, have attended exclusively to the vivid sensational filling of their experience, ignoring their constant but inattentive awareness of the self which has the kinaesthetic and organic sensations? In the opinion

[1] P. 16. Italics mine. Cf. pp. 17 f.

of the writer the introspective records do indeed bear unequivocal testimony to the occurrence of a consciousness of self which the writers do not and could not analyze into sensation-complexes and imagery. This conclusion is based on three considerations.

1. In the first place, as has already been pointed out, phrases constantly recurring throughout these introspections, such as "I found myself," "I must," "I hesitate," certainly seem to show that Wheeler's observers agree with Michotte's and Ach's in finding a self-aspect (*eine Ichseite*) in the volitional situation. To this, however, Wheeler would doubtless object that the use of the personal pronoun in its several forms, direct or reflexive, is a mere convention, a convenience of language from which no conclusion should be drawn. But this position cannot be left unchallenged. For, so long as those who deny that they experience the self claim and exercise the privilege of using language whose obvious meaning is assertion of the consciousness of self, it certainly remains possible that they covertly and unwittingly assume in their analyses of experience the consciousness of self which they formally deny. To state this more concretely: not until Wheeler and his observers describe volitions of different sorts, acceptances of instruction and self impositions, exclusively in terms of sensation, without once falling back on the 'I,' the 'me,' the 'self,' or the 'my'—not till then can they conclusively repel the charge of bringing in by the implication of their phraseology the self whom they directly deny.

2. The critic of Wheeler need not however rest his case on so general an argument as the foregoing. For there are, in the second place, two experiences constantly recurring in the mental processes of Wheeler's observers which he himself formally describes and distinguishes in terms of self and not in terms of distinct sorts of kinaesthetic and organic sensation. To quote his own words: "The acceptance of the *Aufgabe* seems to be . . . in essence a motor response either to the stimulus of self-imposed instructions or of instructions imposed from without (p. 8[3])." The distinction is

repeatedly made. Wheeler says, for example, that when "the materials for the choice were presented without any instructions, the reagent invariably found it necessary to 'accept' self-imposed instructions" (p. 8[2]); and again; *J* "imposed upon himself the subsidiary task to compare the two alternatives (*p*, p. 24)." But Wheeler never tells us precisely what organic or kinaesthetic sensations occur in acceptance of instructions from without and are lacking in self-imposition of instructions, or *vice versa*. This is the more noteworthy in that he has provided us with a rough classification of the kinaesthetic processes into: "First, tensions in the throat and vocal organs . . . relaxation of facial muscles about the eyes, incipient tendencies to smile and tightening in the jaws; secondly, tensions in the neck or incipient movements of the neck of nodding toward . . . the alternative; kinaesthetic imagery with incipient movement of pointing toward . . . the alternative in question; . . . thirdly, a wave of pressure beginning in the chest . . . and extending upward into the throat . . . ; contractions of the diaphragm and external abdominal muscles; . . . and abdominal contractions, relaxations and 'hollow' or 'sinking sensations from the region of the stomach and diaphragm (p. 32[2] f.)" Now if the two differentiated types of acceptance of instruction really are constituted by these kinaesthetic and organic sensations, thus classified, Wheeler should be able to distinguish one from the other by some statable regular difference between the sensation-complex which makes up self-imposition and that in which acceptance of external instruction consists. Any such specific and distinctive analysis, however, Wheeler never makes. Rather, he says with engaging vagueness and generality: "To be vigorous or genuine an act of choosing must involve one or more of the above groups of kinaesthetic or organic processes, not necessarily all the items of any one group, but a majority of them. . . . The contents," he expressly adds, "should not follow any fast and definite rule (p. 33[1])." Indeed, far from distinguishing in sensation-terms these basal experiences,

[1] Cf. pp. 23, 25; and for introspection cf. esp. p. 45.

Wheeler actually differentiates them in terms of self. For 'self-imposed instruction' is of course 'instruction by myself,' whereas 'instructions imposed from without' are imposed by other selves. Thus by the actual fashion in which he makes his own technical distinctions Wheeler belies his claim to reduce the alleged self-awareness in choice to sensational constituents.

3. The final reason for challenging Wheeler's reduction in self to sensational complex centers is the fact that self-questioning is a frequent prelude to his observers' choosing. "Observer *E*," Wheeler says, "very seldom experienced a final decision or a vigorous tendency to choose which he did not delay by the self-questioning: 'Do I really want to hear this?' 'Why do I want this alternative?' (*k*, p. 25[2])." The records of several other observers abound in similar introspections. A "brief period of suspense" in *B*'s case was "characterized by muscular strains . . . and by a vocal-motor self-questioning 'What am I to do? What do I know about the 'Rondo' selection?' (*c*, p. 9[4] f.)." *D* "asked himself," in vocal-motor-auditory imagery 'Do I really want to hear this?' (p. 16. Cf. *g*, p. 17[2]). Similarly, *F* had the vocal-motor imagery "Which of these do I want?" (*l*, p. 42[2]). And in addition to these cases of self-questioning in verbal terms which precede volition, Wheeler's records contain instances in which the final stage of choice seems to consist not in merely organic-kinaesthetic, but in verbal, that is auditory (or visual) together with vocal-kinaesthetic sensation or image. Thus, the introspection of *A* terminates in "the vocal-motor-auditory: . . . 'Hurry up and present them to me (*a*, p. 5 f.)'"; and that of *D* in the words "I will take this one (*g*, p. 17[2])." And *J* is "aware of a long drawn-out, breathy, auditory 'Oh, I want this' (*n*, p. 13)."

Wheeler explicitly interprets these self-questionings, and by implication conceives the final phases of these choices, as a mere series of vocal-motor or motor-auditory sense-complexes. And without doubt the questioning experiences do contain these complexes. But that they are not constituted by the verbal complexes is clear from the simple consideration, ignored by behaviorists and sensationists alike, that a precisely similar self-questioning may be experienced involving radically different verbal terms. For example, if *D* had said to himself: "Qu'-est-ce que je sais?" instead of "What do I know?" his experience of doubt would admittedly have remained the same but his vocal-motor-auditory complex would have been utterly different. Now, obviously self-questioning can not consist solely in verbal sense-complexes if precisely resembling questions are characterized by radically different sensational factors. Indeed, only the heavily weighted sensationistic bias of traditional psychology could conceal from any open minded observer the patent fact that the core of the experience indicated by such words as "Do I really want to hear this?" or "I prefer to hear it," is not the imaged sound or kinaesthetic 'feel' of the particular words, do—I—want—hear. Something is experienced here besides the verbal sense-complex; and Wheeler's expression 'self-questioning' certainly suggests that this something includes an 'awareness of self' analyzable in terms of the basal attitudes or characters of the self. In any case, the fact that Wheeler so constantly reduces his observers' self-awareness to verbal terms gravely discredits the success of his attempt to explain away their introspective testimony to a consciousness of self.

IV.

The outcome of the study just undertaken of the introspective records of Wheeler's subjects is thus completely to discredit his opposition to the conception of choice as involving a consciousness of self. For these records show that, not only incidentally but in technical description, both Wheeler and his observers unmistakably imply the awareness of self. In the face of this discovery it seems at first sight impossible to account for their persistent denial of the occurrence of such a consciousness of self. But the explanation of the seeming discrepancy lies close at hand. The study of Wheeler's comments on the introspective records shows conclusively that neither he nor his observers really understood the nature of the alleged self-awareness which they denied having. "In a voluntary choice," Wheeler says, "there is no consciousness of activity as such, no awareness of an immediate and unanalyzable self (p. 51[4])."[1] And again: "Never did the consciousness of the self or of willing resolve itself into a rigid and fixed synthesis of elemental contents or into any isolated mental content (p. 29[2])." But these assertions are far from discrediting the view that volition includes a consciousness of self. For none of the psychologists whom Wheeler opposes describe the self as an elemental content and at least one of them, the present writer, has been at great pains to describe the self as complex, though undefinable.[2] In truth, Wheeler's repeated asseverations in maintenance of his thesis, that his observers were never conscious "in elemental fashion . . . of the self," throws the gravest doubt on his statement that they were familiar with the concept of the will as involving self-activity. Rather, the self whose presence they deny, the 'self-element,' is—to paraphrase Spinoza—as different from the complex, concrete, immediately observed self as the dog in the heavens, the constellation *Canis*, is different from a living, barking dog.[3]

On the fundamental point at issue, therefore, the occurrence in volition of a consciousness of self, Wheeler's results really confirm those of Michotte, Ach and their confrères. As regards the specific doctrine that choice is immediately realized as self-activity, the introspective records of Wheeler's subjects, though non-committal, are not incompatible with the Michotte-Ach conception, since the only 'activity' which these subjects deny feeling is once more a fictitious activity-

[1] Cf. p. 28.

[2] Cf. 'The Self in Scientific Psychology,' *Amer. J. of Psychol.*, 1915, 26, 495.

[3] It is interesting to notice that in several cases the 'self-consciousness' which the observers reduce to a kinaesthetic and organic sense-complex, is nothing other than the observer's consciousness of his body. One of the observers, indeed, *J*, explicitly describes the awareness of "my bodily self, involving kinaesthetic sensations, visually localized, about my throat, face, and chest (p. 28)." (Parenthetically it may be observed that J's use of the qualifying adjective 'bodily' implies the existence of a non-bodily, a mental, self. For if every self were a body, a self would no more be called bodily than a cube is called a solid or a square a rectangle).

element.[1] In favor, also, of the self-activity conception is the fact that Michotte and Ach meet a crucial test which Wheeler evaded. As will be recalled, Wheeler does not distinguish specifically different kinds of choice by specifically different types of kinaesthesis but himself falls back on the distinctions of self-psychology.[2] The theory of Michotte and Ach, on the other hand, is specific and not merely general. They do not simply enumerate different forms of choice and assert, in each case, "introspection shows that the feeling of activity was present," but, without recourse to the categories of another theory, they distinguish the different forms of volition from each other. So, for example, Ach distinguishes weak volition from normal volition by the fact that in the former case the emphasized consciousness "I will" is replaced by a combination of the relatively impersonal consciousness "this is to happen" and the relatively inactive awareness "I am ready (*Ich bin bereit*)."[3] And Michotte distinguishes the will proper from adoptive will,[4] contrasting both, as forms of self-activity, with the receptive or inactive consciousness.[5] Further and more detailed consideration of the self-psychologist's conception of will would lead too far afield. The point of the present paragraph is simply that the mere denial by Wheeler and his observers of the occurrence of a 'feeling of activity' can hardly hold against the discriminating introspection of the Michotte-Ach observers. And this is the more true since, so obviously, the Wheeler observers do not mean what Ach's and Michotte's mean by 'feeling of activity.'

[1] It may well be noted that (from the standpoint of self-psychology) Wheeler's own account of choice as made up of kinaesthetic sensation, is incomplete unless it makes reference to the self. For the very awareness of kinaesthetic sensations, so far from precluding awareness of self, really and concretely is the awareness of the self's sensings. In the words of S. Alexander, who certainly is not biased by an over-idealistic philosophy: "Even in sensation it is we who have the sensations ('Space, Time, and Deity,' I, p. 105[2])." Even, therefore, if Wheeler were right in identifying choice with kinaesthetic sensation he would, none the less, be unjustified in denying the awareness of self.

[2] Cf. page 367 f. above.

[3] *Op. cit.*, pp. 280 ff.

[4] These terms are the writer's, not Michotte's.

[5] *Op. cit.*, p. 195[3].

In conclusion, heavy stress should fall upon the fact that the positive outcome of Wheeler's study, the experimental demonstration of the occurrence, in each phase of choice, of kinaesthetic and organic sensation, is entirely unaffected by this criticism of his negative doctrine. The truth seems to be that volition includes both awareness of self-activity and kinaesthetic-organic sensation. And as a matter of fact upholders of the self-activity conception have always been of this opinion. So Michotte, for example, whose procedure Wheeler has followed, finds in his subjects' experience not only the feeling of self-activity but kinaesthetic sensation due to head movements, feelings of 'muscular activity' and 'relaxing tension,' respiratory and "articulatory sensations." [1] And Ach's observers record similar sensational experiences, for example, "vivid sensations of strain in the forehead and in the organs of speech" and "strong strain-sensations in the abdomen, larynx and forehead,[2] as well as the consciousness of the activity of the self (*Betätigung*). *Per contra* the alleged reduction by Wheeler's subjects of self-awareness to sensational complex is often made in terms entirely compatible with the view that volition is a consciousness of self-activity, though it includes the kinaesthetic sensational consciousness. For example: Wheeler's statement that circulatory and respiratory sensations (together with rapidity of attention-shift) [3] "were the basis of any tendency to interpret [*B*'s] experiences as feeling of activity (*d*, p. 30)" is not equivalent to saying that these organic sensations were the exclusive *constituents* of the experience. Again, the statement that choice is 'meant' and fondness 'indicated' by a complex of circulatory, respiratory, stomach, diaphragm and throat sensations (*m*, p. 18) is not synonymous with the description of choice and fondness as *consisting in* these sensations. Even more obviously, to say that kinaesthetic and visual sensations "represented to me that I was in the act of accepting this title (*n*, p. 13)" does not assert that the kinaes-

[1] *Op. cit.*, pp. 194 f, 192, 189 *et al.*

[2] *Op. cit.*, pp. 232 *f*, 192.

[3] It should be noted that according to the self-psychologist attention is an attitude of self.

thetic sensations constitute my acceptance: rather it implies the difference of the sensational symbol from the actual accepting.

We end, therefore, by confirming Wheeler's facts, but rejecting his interpretation of them. More definitely, we accept the positive results, entirely compatible with each other, both of Wheeler and of the introspecters whom he criticises. The outcome is a conception of the self in volition as both kinaesthetically and 'actively' conscious.

THE CORRELATION BETWEEN INTERESTS AND ABILITIES IN COLLEGE COURSES

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In the July, 1920, number of the REVIEW, Bridges and Dollinger have presented interesting correlations between (A) the position in which a college student puts one of the subjects which he is studying for interest to him in comparison with the other subjects which he is studying, and (B) the mark which he receives in that subject in comparison with other students taking it. The coefficients (of mean contingency) are:—for Psychology, .22; for English, .27; for all subjects in general, .25.

These are instructive facts, but an equally important relation, perhaps, is between (A) above and (C) the mark which he receives in that subject *in comparison with the marks which* HE *receives in other subjects.* By Dr. Bridges' courtesy, his original data have been put at my disposal to compute this.

We obtain for each student a record like this:

Subjects studied	Rank for interest	Letter Grade	Rank for Grade received
a	1	G	2
b	3	A	4½
c	2	G	2
d	5	A	4½
e	4	G	2

The grades are M, G, A, P, and F, in order of excellence; M being highest.

The correlation for any such case is easily obtainable by

$$r = 2 \text{ cosine } \frac{\pi}{3}\left(1 - \frac{3\Sigma \text{ differences}}{n^2 - 1}\right) - 1.$$

The differences in our illustration are 1, $1\frac{1}{2}$, 0, $\frac{1}{2}$, and 2, summing to 5, making $r = .58\frac{1}{2}$.

I have so computed the correlation in each of one hundred and forty cases taken at random from Bridges' data. It varies as shown in the table below, and has a central tendency of .46, very much higher than the correlation between interest rank within the individual and grade in comparison with other individuals as determined by Bridges. It is lower than the correlation obtained when an individual's ranking of subjects for interest is correlated with his ranking of them for his ability in them as he estimates it. The central tendency of this latter correlation (using the same hundred and forty cases of Bridges) is .70. This again is lower than the similar correlation (.89) obtained by the writer,[1] but using seven subjects of study (literature, science, mathematics, history, music, drawing, and other forms of hand work), for all individuals alike. The discrepancy here is probably explained by two facts. First, the variation in subjects is so much greater in the writer's data. Bridges' data almost never include music, or 'other forms of hand work'; do not include mathematics or drawing in a majority of cases; and often present a list of very closely allied subjects. For example, the subjects for five students taken at random are:

1. Physiology, American History, English, Psychology, German.
2. Physiology, Latin, Literature, Psychology, German.
3. Algebra, Drawing, English, Chemistry, Spanish.
4. Mathematics, Drawing, English, Chemistry, Spanish.
5. History, Psychology, English, Chemistry, Spanish.

Second: Bridges' students reported on the special courses which were being taken at the time. Mine reported on general interest in the subjects as a whole, and over several years. His rankings both for interest and ability are thus 'attenuated' in correlation by chance factors of the special topic studied and the instruction received. It seems likely therefore that the .70 for the Bridges data and the .89 for the Thorndike data agree closely when the general relation between estimated interest and estimated ability is inferred from them.

Returning now to the lower correlation (.46) found when the different grades obtained by a student rather than his estimates are used as measures of his relative ability. Is the difference between this .46 and the .70 due to the student's over-estimation of the resemblance between his ability order and his interest order, or is it due to the chance errors in the grades? There is good evidence that the latter is the main cause, so that the .70 is the truer fact. This evidence is the correlation between (D) the order of abilities within an individual as he estimated *his abilities*, and (C) the order of his grades. This correlation is only a little higher than that

[1] *Popular Science Monthly*, Nov., 1912, and *School and Society*, Feb. 10, 1917.

between his order of interests and the order of his grades; its central tendency is .47, the details for the hundred students being as shown in Table I. The grades tally almost as closely with estimated interest as they do with ability. The order of a pupil's interests as he estimates them gives almost as good a prophecy of the order of his grades as does the order of his abilities as he estimates them. Neither gives a very close prophecy because the distinctions involved are so fine—and because the grade received in a single course is so afflicted with chance error. Widen the distinctions (as by comparing mathematics, languages, physical science, history, drawing and music) and reduce the chance error (as by taking the average mark in four or more courses in each) and the correlation between interest and ability will surely rise considerably above .70.

On the whole Bridges' data seem to corroborate the doctrine of a very close relation between the order of an individual's interests and the order of his abilities. Within the restricted range of a group of rather closely similar studies and subject to 'attenuation' by the circumstances of a single course and teacher, $r = .70$. This correlation does not appear to be dilated by a tendency of the students to make their ability ratings follow their interest ratings unduly, for the grades correlate almost as closely with the latter as with the former.

TABLE I

THE RELATIONS BETWEEN THE ORDER OF INTEREST, THE ORDER OF ESTIMATED ABILITY, AND THE ORDER OF GRADES FOR EACH OF 140 COLLEGE STUDENTS, USING THE DATA OF BRIDGES ('20) FOR ONE SEMESTER

Sum of differences in rank	r	Student's estimate of interest with his estimate of ability	Student's estimate of interest with grade he obtained	Student's estimate of ability with grade he obtained
0	1.00	11	1	1
1	.98		0	1
2	.93	35	7	14
3	.85		12	10
4	.73	42	20	21
5	.59		16	15
6	.41	26	43	35
7	.22		9	11
8	0	16	91	20
9	neg.		9	6
10	neg.	8	4	5
11	neg.			1
12	neg.	2		
Median of the r's		.73	.41	.41
Estimated central tendency correlations		.70	.46	.47

A DEVICE FOR DETERMINING COEFFICIENTS OF PARTIAL CORRELATION

BY CLARK L. HULL

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The need for weighting mental tests with such precision as to secure the maximum accuracy of prediction from a team of them has necessitated a very general use of partial correlation by psychologists. In the past the labor involved in making the necessary computations where more than three or four tests were involved, has been rather formidable. In 1916 Kelley published a set of tables which very greatly reduced this labor.[1] There was such a demand for them however, that the edition was soon exhausted and they are now out of print. Kelley has recently responded to the demand for a new edition of his tables by publishing a monograph or computing chart by which various operations indicated in Yule's formula may be performed much as on a slide rule, leaving only a minor computation to be done by hand.[2]

Since the present method of determining coefficients of partial correlation takes its point of departure from Kelley's tables, it is desirable to consider somewhat their derivation and use. Yule's formula for partial correlation is:[3]

$$r_{12.3} = \frac{r_{12} - r_{13} \times r_{23}}{\sqrt{1 - r_{13}^2}\,\sqrt{1 - r_{23}^2}}$$

Now the right side of this equation may be broken up into three distinct parts:

$$\frac{r_{12} - r_{13} \times r_{23}}{\sqrt{1 - r_{13}^2}\,\sqrt{1 - r_{23}^2}} = r_{12}\,\frac{1}{\sqrt{1 - r_{13}^2}\,\sqrt{1 - r_{23}^2}}$$

[1] Truman Lee Kelley, Tables: To Facilitate the Calculation of Partial Coefficients of Correlation and Regression Equations. Bulletin University of Texas, No. 27.

[2] Truman L. Kelley, Chart to Facilitate the Calculation of Partial Coefficients of Correlation. Special Monograph No. 1, Stanford University Publications.

[3] Yule, G. U., 'Introduction to the Theory of Statistics,' p. 239.

$$- \frac{r_{13} \times r_{23}}{\sqrt{1 - r_{13}^2}\ \sqrt{1 - r_{23}^2}}$$

It will be noticed that the two fractions found in the right hand member of the above equation involve no variables except r_{13} and r_{23}. And since there is a limited number of combinations of these two variables if taken only to two decimal places, it becomes practicable to compute once and for all the values of the two fractions for all possible cases. With the values of these two fractions tabulated as *A* and *B* respectively, a coefficient of partial correlation involving two-place coefficients of zero order may be obtained merely by multiplying the *A* by r_{12} and subtracting the *B*. Thus Kelley's tables reduce to two operations a formula calling for ten.

It is easy to show that if Kelley's *A* and *B* functions are represented on rectangular coordinates, the position of all combinations of r_{13} and r_{23} which make a given sum, occupy an optically straight line; and that the lines for the different adjacent sums are nearly parallel. Moreover, lines connecting combinations of *r*'s making a given difference are also optically straight and nearly parallel. Lastly, the sum-lines intersect the difference-lines at angles not far from 90°. Fig. 1 shows a part of a chart with the various sum- and difference-lines drawn in. It is evident that any pair of r_{13} and r_{23} values is determined by their sum and difference, and may readily be located on the chart by noting the intersection of the two lines in question. The distance from the point of intersection to the broken line *MN* will be the spatial equivalent of $\frac{1}{\sqrt{1 - r_{13}^2}\ \sqrt{1 - r_{23}^2}}$ or Kelley's *A*, and its distance from the line *ST* is the spatial equivalent of

$$\frac{r_{13} \times r_{23}}{\sqrt{1 - r_{13}^2}\ \sqrt{1 - r_{23}^2}}$$

or Kelley's *B*.

Now if a transparent stencil with a design such as is represented in part in Fig. 2 be superposed upon Fig. 1 in such a way that the point within the circle at *A* falls upon the intersection mentioned above, the point where a given line of the stencil (as 17) cuts the scale QR will indicate directly the coefficient of partial correlation required. The numbers of the lines in Fig. 2 correspond to values of r_{12}. The slope is such that it multiplies the distance A by the particular

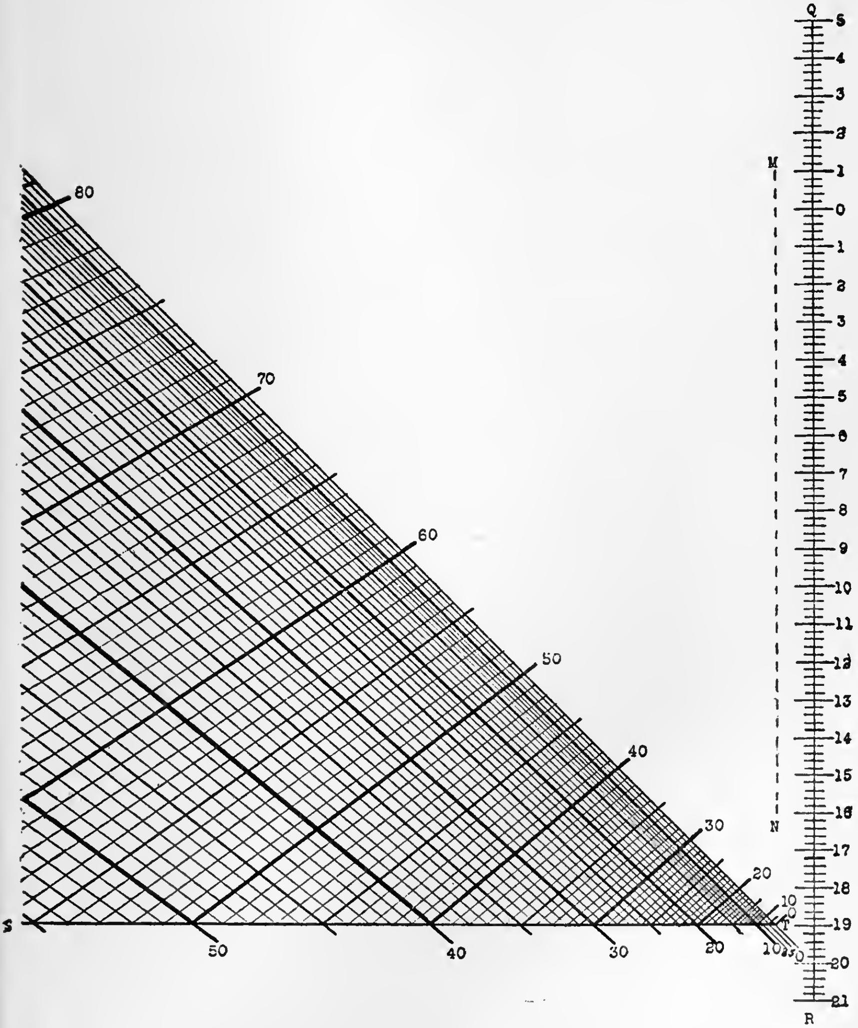

FIG. 1. This shows a sum and difference chart of Kelley's A and B functions, together with the scale (QR) for reading off coefficients of partial correlation. The numbers on the diagonal indicate the sum-lines and the numbers on the horizontal at the bottom indicate the difference-lines.

r_{12} indicated. And since the distance B moves backward along the scale QR, this is equivalent to subtraction. Thus a single setting of the stencil multiplies and subtracts simul-

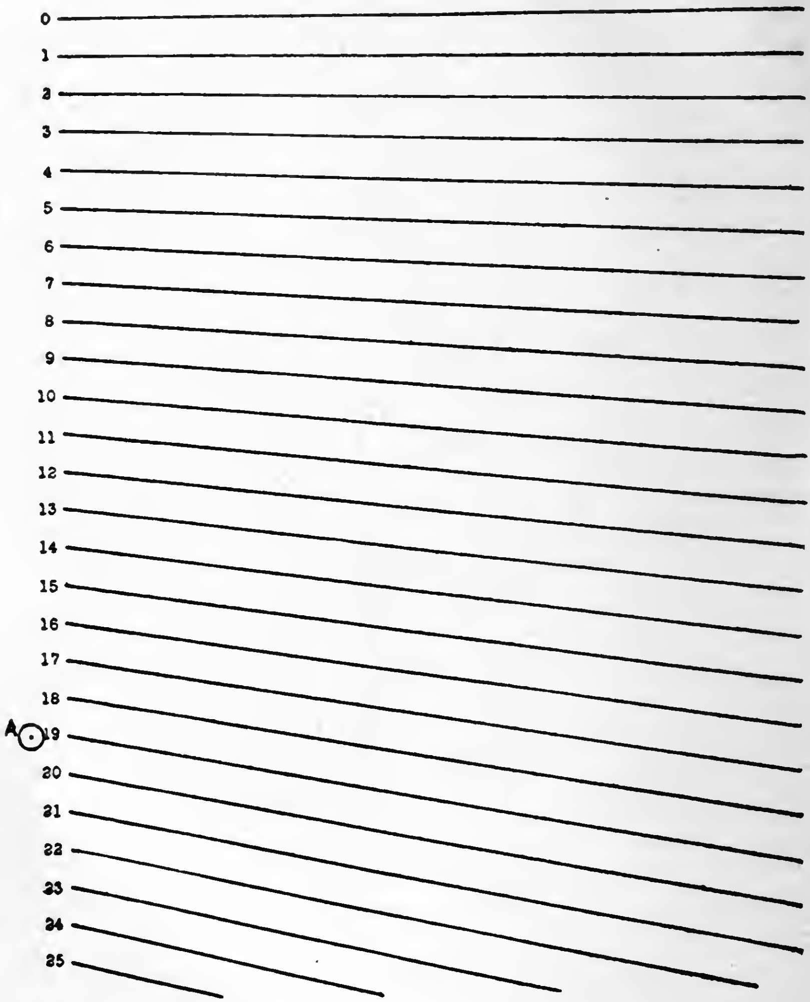

FIG. 2. This shows a section of the transparent stencil that is placed over the chart represented in part in Fig. 1.

taneously with the result that the partial correlation coefficient corresponding to any value of r_{12} may be read off directly.

In case the B needs to be added instead of subtracted, as sometimes happens, the stencil is merely turned face downward in such a way that the top of the stencil appears at the bottom of the chart, when the $r_{12.3}$ may be read off on the scale *QR* as before. In this case, however, the scale must be renumbered, the numbers appearing on the left of the line.

By a method somewhat similar to that just described, the sums and differences may also be read off directly, thus eliminating from partial correlation all computation whatsoever. In Fig. 3, scale *EG* and lines *DG* and *FG* are understood as drawn on the chart, and scales *AB* and *BC* on the superposed stencil. Now it may be shown that:

$$GH + BH = BJ$$

and

$$GH - BH = BK$$

Accordingly, if *GH* represent the larger of two *r*'s and *BH* the smaller, then the point of intersection of line *DG* on the scale *AB* will indicate their sum and the point of intersection of line *FG* on scale *BC* will indicate their difference.[1] It may be noted in passing that the scales *AB* and *EG* are so made that the readings for both *r*'s fall at the same point (*H*) which makes the setting of the stencil very simple. The device represented in Fig. 3 may conveniently be placed on the same chart and stencil with the material previously described.

For zero order *r*'s involving only two-place numbers, the sums and differences may also be read directly from a small table. All those likely to be used, those up to 70 + 70 say, may be arranged in a single triangular table and placed for convenient reference on a corner of the chart not needed for other purposes.

Both settings of the stencil described above assumed that the stencil is to be held parallel with the chart. This parallelism may be secured by drawing vertical lines on the stencil at intervals such that no matter where the stencil may be placed, one of them will fall close to the line *QR* on the chart, thus permitting the eye to detect readily any deviation from the parallel. Intervals of about a centimeter seem to work well in practice.

[1] In case *GH* represent the smaller *r* and *BH* the larger, both sum and difference may be read off directly on scale *AB* and scale *BC* may be dispensed with.

A second method may be used instead. The chart of Fig. 1 is mounted on a light board of suitable dimensions, which is supported like a little table, by legs about an inch high. Be-

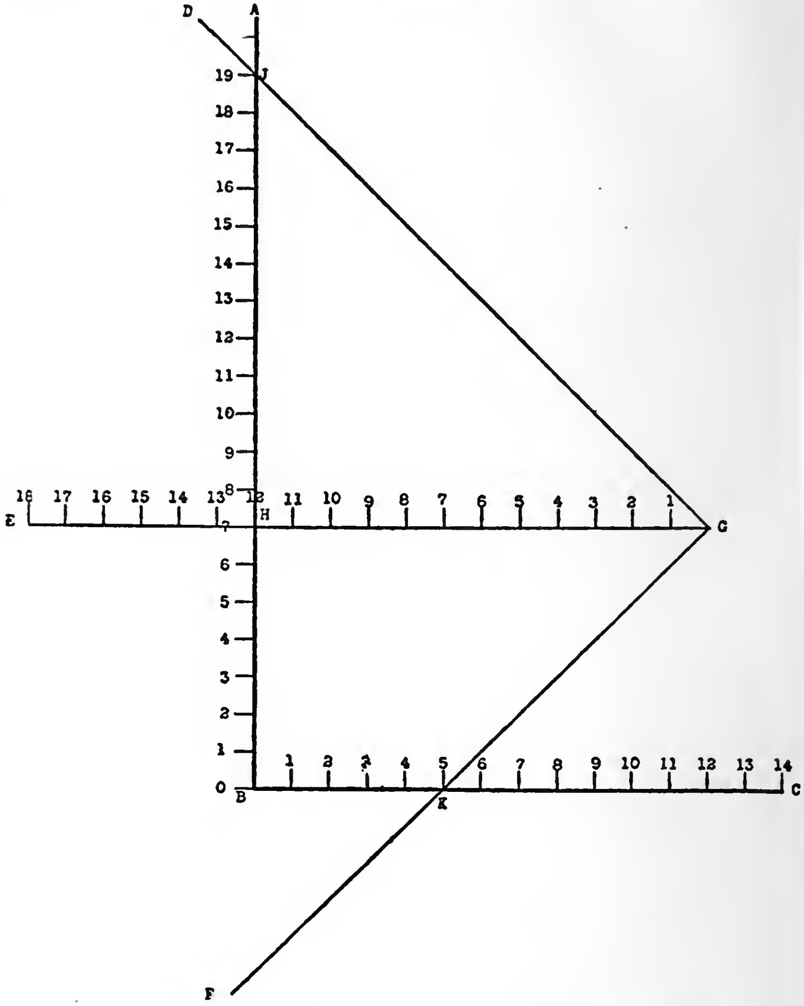

Fig. 3. This shows the addition and subtraction device with the stencil set to give the sum and difference of 12 and 7. The sum is read off directly at *J* and the difference at *K*.

neath the upper right hand corner of this board is attached a light set of steel levers so constructed that anything attached to the movable end of them can move freely within the desired area, yet will always maintain a strict parallelism somewhat after the fashion of the universal drafting apparatus. This movable end of the lever system projects from beneath the right side of the board, extends upward to the level of the stencil and is attached firmly along the right edge of the latter. The stencil can then be moved about freely in all desired positions yet will always retain a strictly parallel position with respect to the chart. But since this arrangement does not permit the turning over of the stencil, an extra set of multiplying lines are drawn on the stencil sloping in the opposite direction, to be used in cases where the *B* must be added. The two sets of multiplying lines make an angle with each other of about 65 or 70 degrees.

Since correlations higher than 75 are rarely met with in mental testing and combinations of two *r*'s making a total of 130 almost never, the charts used by the writer only give sum values up to the latter amount, with difference values to correspond. The latter rarely exceed 50 though the chart gives them up to 80. This makes a chart and stencil each 20 × 24 inches and yields results accurate to about .0005. By its use coefficients of partial correlation may easily be determined in 30 seconds from two-place zero order coefficients, three-place coefficients requiring somewhat longer.

The device is being used regularly in the Wisconsin laboratory in connection with an extensive program of vocational testing. If it seems likely to have a wider usefulness, reproductions will be printed and distributed at cost. In the interim, it is hoped that the above description may enable any especially interested individuals to construct the device for themselves. Both chart and stencil are drawn on the slightly roughened surface of 1/16 inch sheets of celluloid which have been 'frosted' on one side. Such frosted surfaces receive the ink very well. The surfaces are then shellacked rather heavily. This protects the ink and at the same time restores the transparency to the celluloid. The lines on the stencil should be on the under side so as to make as close contact with the chart as possible and thus facilitate precision in reading. Celluloid is used for the chart rather than paper, in order to avoid shrinking and swelling from changes in humidity, which would seriously impair the precision of the instrument.

385

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THE PSYCHOLOGICAL REVIEW

ASSOCIATION AS A FUNDAMENTAL PROCESS OF OBJECTIVE PSYCHOLOGY

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From the early dawn of psychological history when thinkers first began to reflect upon the mysteries of human behavior, they were attracted to the processes of association especially as they are manifest in memorial and kindred activities. Strikingly enough, too, from our present point of vantage, the early Greek thinkers, standing upon a common-sense basis of reflection, merely described in the manner of an unadorned narrative what appeared to happen when one stimulus-object called out a reaction to another stimulus,[1] or when they essayed an account of the incidents involved in the act of remembering or recollecting.[2]

But with the rise of the modern spiritualistic psychology the problem of association became extended and the associational process was no longer looked upon as merely a fact of memory, but became regarded as a property of psychic elements or was considered as an explanatory principle to account for the succession and cohesion between states of mind. Thus, in either case the associational process became a universal condition for all psychological phenomena, even to the existence of a stable mind, and was subject, of course, to all the criticisms of which a thoroughgoing mentalistic psychology becomes the target.

Associationism, however, suffered less from this criticism, as the records of psychological history show, than from a

[1] As the classic passage in Plato's Phaedo, 73–6, bears witness.

[2] For example, Aristotle, De Memoria, II., 6–11.

general tendency toward innocuousness and superfluity induced by the displacing activity of biological theories. When in the middle decades of the nineteenth century psychological phenomena became looked upon as the activities of biological organisms a basis was found for mental phenomena (which were themselves now considered as processes within the structures of the organism). This basis it is needless to say was the neural apparatus. Now while the data of psychology still remained mental for the biological psychologist, the machinery of association as a general principle of psychic unity he could dispense with, though he retained it to account for the orderly connections between the elements of what he called the purely mental reactions, namely, imagination and thought.[1]

Comes now a time when psychologists are modifying their conception of their science, a time in which psychological phenomena are more and more frequently considered as total unitary adjustments to stimuli, and not either exclusively mental or physiological facts or parallels of the two.[2] As a normal consequence of this new attitude association becomes again a general process involved in all psychological behavior. Increasingly accepted becomes the view that association constitutes the connections between responses and their stimuli.[3] We submit that no psychologist, whatever be his theoretical views, would deny that conditioned reflex phenomena are associational facts.[4] Moreover, the workers in comparative psychology find it most expedient to treat the animal's

[1] For a statement that undoubtedly will remain for a long time to come the classic exposition in English of the history of Association, *cf.* Warren, 'A History of the Association Psychology,' 1921.

[2] In this connection, we believe that, although Hunter ('A Reformulation of the Laws of Association,' Psychol. Rev., 24, 188) appears to be arguing for a reformulation of the law of mentalistic association, proposing that it be not confined to ideas but also be made to include sensations, he is really suggesting that we should make association cover response acts as well as merely mental states. It is interesting to note that Hunter's quotations suggest the fact that while psychologists have always observed the connections between reactions it still appears that their failure to exploit the fact is owing entirely to their mentalistic presupposition.

[3] Hunter (*loc. cit.*) makes this point when he subscribes to the view that the principle of association is the principle of habit formation.

[4] Cf. Warren, *loc. cit.*, p. 257.

organization of stimuli and responses as definite facts of association precisely as in the case of the human organism.[1] Psychological history repeats itself then in the matter of the pervasiveness and importance of associational processes, but with how striking a difference in the two periods. Instead of a mentalistic property or a statement of mental connections, associational processes are now looked upon as definite objective facts of psychological behavior. The purpose of the following paper is to attempt to bring together some of the conspicuous points involved in an objective investigation of psychological association.

I. *The Problem and Nature of Association.*—In its largest aspects the problem of association is the determination of the nature of the orientation of the psychological organism in its surroundings and the means whereby this orientation is achieved. In other words, the problem of association is the discovery of the conditions for the various interrelationships between the organism and its environmental complexities.

In detail, psychological association refers to the effects which specific objects and particular grouping of objects have upon persons in eliciting from them responses of various sorts, and furthermore, the association problem involves the discovery of the effects upon the organism of the various changes in the relationship between objects. Now consider what this means when we add that psychological association carries over to the interrelationships of persons in social situations. Here we must take account not only of the intricate orientation of persons in exceedingly complex surroundings, but moreover, we must observe that the various individuals are mutually influencing each other in the course of such adaptations; so that while changing behavior to adapt themselves to each other they at the same time provide new stimuli for the further modification of the other person's behavior, which in turn creates for the individual in question newer necessities for adaptation and orientation.

[1] *Cf.* the work of Carr, for example 'Length of Time Interval in Successive Association,' Psychol. Rev., 1919, 26, 335.

Precisely how important a psychological phenomenon association really is may be readily gathered from the fact that if we include its elementary forms it is indubitably a *sine qua non* of psychological activity. For the essential point about psychological phenomena is the intimate association of a specific response with a particular stimulus. When the organism has acquired responses sufficient to connect him with a large number of surrounding objects then we consider it as oriented in those surroundings, since the organism will then be able to perform behavior serviceable to itself in the given situation. In more complex situations, that is to say, when responses must be prepared for before their actual operation, and when the response must be delayed and in consequence aroused by substitution stimuli,[1] then we must also have our surrounding objects and events themselves so related as to form interconnected stimuli.

We repeat, that only on the condition that the objects or events of the person's surroundings are orderly and systematically connected can he develop intelligent and rational behavior. For intelligent behavior implies a final directness, certainty, and efficiency of responses which are impossible without a definite interrelationship of the various stimuli with other stimuli and with the person.[2] Let us therefore at the outset observe that we mean to depart from the older tradition of modern psychology and look upon psychological association not as a condition of happenings entirely within the individual himself, as the historical term association of ideas implies, but rather as a series of phenomena involving always the reactions of the person in specific relationships to surrounding stimuli, both things and persons. Not in the slightest does this mean that we entertain the idea of excluding from associational phenomena the connections between the individual's reactions. To do this would mean to pass over an extremely important series of psychological happenings. How far we are from committing such an error may be

[1] As in meaning reactions.

[2] This emphasis of the stimuli factors, in view of the spreading prevalence of the behavioristic conception of association, is probably the main point of our discussion.

judged from the fact that we do not even exclude from the forms of psychological association the connections between stimuli-objects themselves. When we accept the hypothesis that association means the reactional orientation of the individual we thereby make room for all forms of associational connection.

But we hear the strident voice of objection saying, "All this you have written represents association almost entirely as a condition of psychological behavior, an essential condition perhaps, but still a condition merely, whereas by common consent psychological phenomena are constituted of responses to stimuli." Especially pointed appears this protest when directed toward our inclusion among associational data of the relationship between objects, for it practically amounts to a destructive criticism of our theory. And yet an examination of the facts in the case renders this objection innoxious. To this examination we shall now proceed.

And first, we propose to suggest that although psychological association must always involve a prominent element of purely physical relationship between objects, relationships which indeed greatly influence psychological behavior, still such physical conditions do not become psychological data except through the influence they have upon reacting organisms. It is only because an object and its connection with other objects are coördinated with the responses of the persons that they become of interest to the psychologist. This means to say that from a psychological standpoint it is because the proximity of and similarity between reactions are induced in the person by the proximity and similarity between objects, that the latter are admitted into the psychological domain. Now let us see what is the net result that we have reached.

Briefly, we have arrived at this conclusion, that although we cannot exclude physical connections between objects from the domain of psychological association it is to be observed that their inclusion among the data of psychology is only justified because such objects and their association are the stimuli for specific forms of reactions. It remains merely to add that when we generalize the question whether a physical object is or is not a psychological datum we must declare that the question depends entirely upon the functional condition of such physical objects, or in plainer words, depends upon whether they are or are not operating to arouse an organism to action. When a physical object induces a reaction in the organism, that object obviously becomes a datum for psychology and we call that object a stimulus.[1]

Nor is the situation any different in the case of connections between reactions even when the reactions are ideas, in spite of the frequency with which they have historically been considered the sole elements of association. Let us be absolutely clear in our contention at this point. Since nothing other than a response to a stimulus may be considered as a psychological fact, we cannot admit the mere connections between reactions as psychological data any more than the mere connections between physical objects. No, reactional connections are not psychological facts unless they are responses to stimuli. Be it observed, however, that this does not mean that each unit of response or reaction system must necessarily be the response to a stimulus. On the contrary, the response member of a stimulus-response couple may consist of a group of reactions not one of which is a stimulus to another but all taken together constitute the response to whatever object or action of an object or person happens to be the stimulus.

We doubt much whether we need to protest, after our foregoing discussion, that our standpoint is whole-heartedly naturalistic, and that as scientific data we make no distinction between physical and psychological facts, tremendous as are, of course, the differences between the materials of the two domains of study. But it may not be superfluous to repeat that not because responses are organic activities are they data of psychology but rather because they are specific responses to particular stimuli. It is for this reason that we pointed out the similarity between responses and stimulating objects, a similarity which we may best state by observing

[1] A datum of psychology, we assume to include a stimulus as well as a response.

that each is a reciprocal phase of a single psychological fact. Furthermore, if we agree that no more special psychological quality inheres in the response than in the stimulus we cannot possibly make the mistake that the reaction in an associational situation is anything but an actual adjustment of the organism. Frankly, what we have especially to guard against is the idea that an associational member must be some kind of inner process, the traditional mental state for example.

Was it not the overemphasis of the person's responses in the associational process which was responsible for the traditional view that made association refer exclusively to ideas, whether considered as thought processes or as general terms for all psychological activities (awareness)? Very true it is that, at least in human behavior, exceedingly prominent associational activities will involve primarily the implicit forms of action that usually go by the names of ideational and memorial behavior. All of the delayed reactions which constitute the foundation for all complex intellectual operations are made possible through the connections established between the reacting person and things by means of similar and chains of dissimilar ideational reactions. We must not overlook the fact, however, that ideational connections consist of only one phase or form of association, a fact which we have already indicated by saying that association comprises a foundation both for the general orientation of the organism in its surroundings and for learning the most complex intelligent and rational responses.

One point more before concluding this section. We believe our discussion has shown that, while association may well be considered as involving conditions of behavior, association always turns out in the final analysis to be itself a definite form of behavior. This condition refers as we have seen both to connections between stimuli-objects and between reactions. Now we want to point out that psychological association may be considered as a reactional condition in another sense, namely, whenever we build up specific sorts of responses to particular stimuli, or in other words when we form associations, we invariably create a condition for the later operation of those associations when appropriate occasions arise. Obviously this condition of association which we are now discussing is unlimited in its comprehensiveness, involving indeed practically every one of our psychological reactions. We can no better state our point here than by saying that the fact of having formed associational connections means that we have prepared a condition for behavior which is nothing less than a latent associational reaction and which under appropriate circumstances becomes active. Accordingly, we might add that associational processes involve three phases of connections. The first phase is active, namely, the formation of the connections, phase two is latent and may be most appropriately called an associational condition, while the third phase is again active consisting of the actual operation of the formed associational connections.

II. *The Basic Roots of Associational Processes.*—Complex psychological association may be considered as rooted in and developed from at least two of the elementary properties of all psychological phenomena, namely, integration and differentiation of responses.[1] By differentiation of responses we mean to refer to the organism's apparent discrimination of objects and their qualities and of the auspices under which the organism is in contact with its stimuli. How is this discrimination manifested? We answer, by the differential behavior which the organism performs when stimulated by different stimulating objects and situations. Now we assume that this elementary and universal behavior quality lies at the basis of the organism's development of its elaborate stimulus and response connections.

Likewise, we postulate a similar foundation for associational processes in the psychological property of integration, by which we understand the intrinsic morphological organization of the responses of the individual. Such integrations of reactions are well exemplified in the development of acts of skill, such as the organization of strokes in writing, of

[1] In addition to integration and differentiation of responses we may consider psychological phenomena to have these characteristics, variability, modifiability, delay, and inhibition of reaction.

movements in dancing, and manual operations in handling complex machinery. Excellently also are the integrative processes observed in the acquisition of speech behavior in infants. Beginning with words the infant integrates these into phrases and sentences. Language in infancy is all the better an illustration of the integrative processes because it shows the line at which integration develops into and merges with the larger and more complex process of association. For the infant (and for the adult also) language is only to a limited extent integrational, while for the most part it is definitely associational. The line of distinction between integration and association we place at the point where a series of reaction systems merge into a larger reaction system. When acts are integrated into larger acts they lose their identity as separate acts, as in the case of the separate t–h and e strokes when they become the "the" reaction system. Per contra the association of reactions in a pattern of response[1] does not involve at all any loss of identity on the part of the associated members.[2]

Upon these two functional foundations and possibly some others are built up all the multifarious combinations of associational connections. Needless it is to say again that it is hardly possible to place a limit upon the number and intricacy of associations which a complex organism develops in its multitudinous contacts with the surroundings; but always the character of the associations, which in all ultimate analysis must of course be brought down to concrete, memorial, manual, or other sort of actual behavior, is determined

[1] Note that the term reaction system and reaction pattern themselves indicate the differences between integration and association. For the former refers to a single unit of behavior of no matter what degree of complexity, while the latter refers to an organization of reaction systems. On the side of the stimulus be it noted also that the reaction system would most probably be stimulated by a single and simple stimulus, while the reaction pattern may be associated with a single complex or a group of stimuli.

[2] Is it necessary to point out that associational and integrational processes may be temporally relative? That is to say, while we have considered integration as prior and more simple than association, this really depends upon the particular stage of development, since the reactions now being integrated may have previously been associationally connected.

by stimulus and response situations. Now since it is a fact that associations are intimately involved in every type and level of our behavior, it follows that there must be an enormous variety of association forms. In the following section we plan, therefore, to enumerate some of the outstanding types of associational connection.

III. *What are Associated?*—If psychological association means the connection and operation of responses to stimuli, then we are in immediate possession of a serviceable method for isolating the association data, namely, to specify the connections between responses, stimuli, and the settings of the stimuli.

For convenience, we plan to adopt the plan of calling simple any association of two or more behavior factors of not more than two varieties, while a connection involving more than two varieties of factors we will call complex. To illustrate, the connection of a stimulus and response, two stimuli, or two responses are simple associations, but when a stimulus, a response of one type, say an implicit reaction, and another type of response are joined together we will call the association complex. While it is certain that most of our reactions include the complex forms of association, we shall still find it very useful to make a list of the simple associations, even if they are finally found to be for the most part abstracted from the complex associations.

Following our proposed plan we may arrange the simple associations into the following classes.

A. The Simple Associates.

1. Associations of stimuli and responses.
2. Associations of stimuli and stimuli.
3. Associations of settings and stimuli.
4. Associations of settings and reactions.
5. Associations of settings and settings.
6. Associations of reactions and reactions analyzable into the following forms:
   a. Association of two or more overt responses.
   b. Association of two or more implicit responses.
   c. Association of two or more partially implicit responses.

d. Association of two or more partially overt responses.
e. Association of overt with implicit responses.
f. Association of implicit with partially overt responses.

Before arranging the complex responses we may first discuss the simpler associations.

1. *The Association of Stimuli and Responses.*—One of the primary forms of association is the connection between stimuli and responses, since without doubt the fundamental psychological fact is the operation of a specific reaction system through stimulation by a particular stimulus. Such a segment of behavior is the basic fact in all orientation and learning adjustments of the psychological individual. Now it is possible to distinguish at least two classes of such associations on the basis of whether the association is primary or secondary. By a primary association we do not necessarily mean an association not acquired in the life of the individual, but one which although acquired by the individual has its basis in the structural character of the person and in the adaptational history of the species of which the individual is a member. As examples of primary and secondary association we may take for the former the reflex behavior segments and for the latter conditioned reflexes and acquired reactions of all sorts. The association in the latter cases consists of the development of response systems for adaptation to specific objects and events.

Another distinction in the domain of stimulus-response association is that between (1) the connection of stimuli with overt responses; this is illustrated by the reflex act, (2) between stimuli and implicit reactions, such as between ideas and their arousing objects, and (3) between stimuli and partially overt and partially implicit reactions; this last situation is exemplified by the connection between a stimulus object and a perceptual response. Needless is it to add that the two kinds of distinction are not mutually exclusive, and moreover even in a single complex action may we find all of the kinds of associates mentioned.

2. *The Association of Stimuli.*—Here we have merely to point out the fact that through the connection of objects, events, and conditions, with other objects, the individual is forced to connect and correlate his reactions to the end of achieving a greater control over his surroundings and of becoming more efficient in his adaptations. The primary process of psychological orientation is the organization of particular behavior combinations because of the interrelationship between objects and events. The general integration of behavior we might say is due to the necessity to adapt to many related objects in a given time. As an illustration of this situation we may take the case of typewriting, in which the various strokes or movements must be integrated in a definite form because of the connections between the stimuli, namely, the combinations of words and letters.

In the association of stimuli we may again distinguish between *primary* and *secondary* connections. In the former case the association between objects may be original and merely discovered by the person in his first contact with the stimuli in question, while in the latter case the stimuli are rearranged and brought into some new relation, in each case of course modifying the behavior of the person. Another name for the primary form of association between stimuli is natural association, while the secondary connections may be called contrived association. Natural connections between stimuli may be illustrated by the relation of two or more houses, and let us observe that by natural we mean only that the connections between objects are formed without the knowledge, aid, and consent of the particular reacting individual. Contrived associations are (1) connection between a stream and a bridge, a person with another person (man and wife, parent and child) or a person and some object (occupational post or residence) and (2) all informational and physical objects connected by learning, creating or through acts of skill.

Most emphatically must we suggest again that while no connection between objects constitutes a fact for psychology unless such a connection operates to effect some form of reaction in an organism, still that connection need not be known by the organism. Very frequently such associations of stimuli are so subtle that the reacting person or observer does not know how connected objects or persons stimulate an individual to respond, nor why the stimulating objects or persons come to assume that office. In many cases, however, the basis of the substitution function is clear; it is found in the similarity or other resemblance between two persons or objects, in the frequency of their relation, and in other cases, merely by virtue of the recent connections between two persons, objects, or events.

To the writer's mind it appears possible that the experimental problem of mediate association finds its solution in the fact that we have just discussed, namely, that we can be stimulated to action by objects or persons whose connections with other things we react to are unknown to us. Another form of stimuli association is the connection between objects serving as signs to call out responses to other things or persons which they signify. This type of association finds a large place in complex action of all sorts and especially in reasoning activities. As compared with the association of substituting stimuli the person reacting to a sign which signifies something else is always fully aware of the relationship between objects. The entire work of scientific and other forms of inferential behavior consists in great part in the development of an efficient capacity to respond to things and conditions when their representing signs appear. To illustrate this form of association let us assume that the high temperature of a patient may stimulate us to seek the means of discovering and controlling a toxic condition or an increased rate of a chemical reaction makes us think of the relative capacities of given catalyzers.

3. *The Association of Stimuli with their Settings.*—Very frequently specific forms of our actions become what they are because of an association existing between stimuli, whether objects, places or events, and objects, places or events serving as the backgrounds or settings of those stimuli. Let us

observe that the specificity of psychological reactions is due not only to the stimulus-object but also to that object in its setting or background, and observe further that it is because these factors are separated that the person is liable to perform an erroneous reaction to the misplaced stimulus. The dependence of a stimulus-object upon its setting is especially familiar in the case of contrasting colors or objects. Through the changes which are introduced in the medium of stimulation by colors placed in close proximity we are made to react to colors differently than when they have other backgrounds. Similarly we are prone to call a man tall or otherwise, because we respond differently to him when he is compared with a shorter person, than when he is likened to an individual taller than himself. Again, objects and events affect us differently when they have certain backgrounds than when they have others. How markedly divergent are our reactions to the same music when played by acknowledged musicians than when executed by unknown persons; again novels or other books of the greatest merit when written by women are by that very fact unreadable for some people.

As to the classification of the associations between stimulating objects and their settings we may, because of the similarity of these associations with the connections between stimuli-objects, call them by the same name. Thus we may speak of natural, original, conventional, or contrived connections between objects and their settings. Among such settings we may include the hygienic and other conditions of the person, as well as the person's relative size and weight as compared with stimuli objects.

4. *The Associations between Reactions and Settings.*—Not only are reactions connected with stimuli-objects, but they may be conjoined with the settings of such objects; so that the setting will serve as a secondary stimulus to elicit the response. We believe that the ordinary case of hallucination is a type of reaction induced in the person by the setting or a stimulus which in the normal course of events would have produced that response. We may readily grant that whenever the setting alone arouses a reaction we must look upon

the setting as the stimulus in that situation, but we must in that case call the setting an auxiliary and not the adjustment stimulus. This is true even when no actual object can be the adjustment stimulus, as is the case in "seeing a ghost."

5. *The Association of Settings and Settings.*—At least from a logical standpoint we ought to include here the connections between settings and settings as a form of association. For if we agree that a stimulus-object may be misplaced then of course the stimulus-object would be connected with two settings. As a consequence we must agree that the connection between the two settings has some influence in conditioning the behavior of the person. That different settings may be related, follows further from the consideration that our reaction to a particular stimulus may be similar to our response to a different object merely because of the influence of a related setting; a government official may respond just as politely to an agent of an unfriendly power as to the representative of a friendly one, provided that in both cases there are present similar conditions which may merely be the diplomatic background. For our purposes here it is well to note that the same physical, social, or political conditions may constitute different settings for stimuli.

6. *The Association of Responses.* (*a*) *Overt Responses.*—In many manual and skill acts we can determine the acquisition of them to consist primarily in the organization of interrelated overt reaction systems to form a definite pattern of response to some stimulating object or situation. Typewriting or swimming illustrate the connection between such overt reactions.

(*b*) *Association of Two or More Implicit Reactions.*—Likewise series of implicit responses may be related to form a pattern response to stimuli, precisely as is the case with overt reactions. Indeed the association of implicit reactions was the first type of association noticed and studied, under the heading, of course, of ideas. In this as in the last paragraph it is necessary to observe that we intend to refer here only to the conjoining of responses and not the connection of responses with stimuli, for in many cases when we have series of responses operating the preceding reactions serve as stimuli to the following.

(*c*) *The Association of Two or More Partially Implicit Reactions.*—The best example of such an association is the conjoining of verbal responses. Verbal articulations are morphologically overt activities but in their operation they may be as elements in thought activities, implicit meaning reactions.

Possibly it is truer to say that they are both overt and implicit, but because their morphological and functional aspects can be distinguished we prefer to speak of them as partially overt and partially implicit. Articulate speech involves large series of conjoined, partially implicit reactions, forming in their various patterns effective specific adaptations to surrounding stimuli.

(*d*) *The Association of Overt with Partially Overt Reactions.*—Any perceptual behavior segment in which the specific perceptual reaction system is connected with some particular overt response following it, is an example of this type of association. Inseparable is this connection arising from the fact that the partially implicit reaction system is a vestige of some actual overt response which is in a sense replaced by the overt action which follows it in the behavior segment.

(*e*) *The Association of Overt and Implicit Action.*—Thought and memory activities exemplify the connections between overt and implicit acts whenever the segment of behavior involves a definite change in some stimulating object, and this, we might add, occurs more frequently than not. In thought processes the implicit behavior may be so intimately related with overt byplay responses that we may truthfully say that pacing the floor, scratching the head and other overt byplay responses are intrinsic factors in the thinking. Better illustrated is this type of association by the facts of planning as anticipatory responses for overt acts as bridge constructing, military campaigning or other types of overt responses.

(*f*) *The Association of Implicit and Partially Overt Reactions.*—In every act of thought the implicit reactions involved are put into operation immediately or mediately by some substitution or associated object. Now the contact with such an object constituting the immediately preliminary reaction to the thinking processes is very frequently a perceptual or partially overt action. Our implicit responses are in great measure conditioned and modified by such connection with perceptual responses. In fact, it is the closer association of implicit responses with perceptual reactions which makes our diurnal thoughts and problem solving different from day or night dreams.

B. The Complex Associations.—As we have previously indicated, possibly the most satisfactory description we can give of complex associations is to say that they constitute various organizations of the connections which we have already attempted to isolate. Thus every complex reaction consists of many interrelationships of stimuli, their settings, and all of the varieties of responses. The primary point here is that the particular modes of orientation and adaptation of the person to his surroundings are functions of numerous specific connections which the person makes during his development and growth, within the range of his surrounding stimuli. Thus for example, in every perceptual behavior segment the specific occurrence involves a connection between the partially implicit and overt responses, with the additional connection of all of these factors with implicit responses. In more complex acts such as planning, the situation is even more elaborate and complicated, and while these acts may involve many overt responses they are so named as to suggest primarily implicit activity because such responses play an unusually important part in the total behavior.

IV. *How Associations are Organized.*—Having enumerated various kinds of association, the problem arises as to what are the attendant circumstances under which these various connections are made. Not only is it clear that different conditions may be responsible for the formation of different associations, but it seems evident that any individual connection may involve a number of specifically different kinds of conditions.

Concerning all of the associations involved in our behavior taken *en masse* we may assert that two general methods of bringing the associated terms together may be isolated, (1) the casual connection of stimuli and responses, and (2) the deliberate connection of the associated terms. By casual association we mean any connection between stimuli and responses or other terms which are not planned or brought about in any purposive manner.[1] The various language responses illustrate both forms of association. We strive to make the child in its early infancy adopt definite, prescribed word responses as the names for objects and thus learn to communicate with others. For the most part, however, the child acquires specific language responses through the sheer casual stimulation by the sounds of other people.

Cutting across both of these modes of forming associations are the more specific conditions observed in the formation of connections. Thus a response may get connected with its stimulus because of frequently having been associated, or because of the great vividness of the conditions under which the associations are made. The conditions are operative whether it is a mannerism which is unwittingly acquired or whether the situation is the training of a child in school. Probably the different conditions can best be isolated by considering separately the six general kinds of association.

1. *Stimuli and Responses.*—To consider first the connections between responses and stimuli we find that such connections are due in some form or other to some or all of the following conditions. (*a*) The necessity of the situation may force us to make particular movements in order to prevent injury or to make any or an adequate adaptation to certain stimulating conditions. Older boys assume this principle when they throw the uninitiated youngster into deep water as a method of forcing him to learn how to swim. Such

[1] It is immaterial, of course, whether the deliberation is that of the acting person or someone else.

needs as we have suggested extend of course to social requirements and prohibitions as well as to physical necessities. (*b*) The frequency with which we perform a given response to a stimulus conditions the formation of a connection at all or the rapidity with which such an association is made. This condition applies more to routine and mechanical forms of responses. (*c*) In many cases an association is formed because of a recent contact with a stimulating object. This condition operates only in what we will later designate as the temporary associations. At this point it is well to suggest that in many cases the sole warrant for asserting the presence or existence of certain associations lies in the fact that we can observe them to operate. The application of this fact receives its importance here in the consideration that an association may be formed and operate once only and never again. In such a case the condition of recency has its most plausible application.

(*d*) Another very strikingly contributory condition for the formation of associations is the vividness of the circumstances under which the reaction is made to the stimulus. Illustrative of this condition are the first acquisitions in school, the facts occurring in the presence of persons loved, feared, or respected, and associations made in the presence of danger or distress or under conditions of great happiness or importance to the person. (*e*) Associations involving rewards and punishments of various sorts are facilitated or hindered by these conditions in whatever form they occur. (*f*) And in many cases associations are developed as definite or indefinite means to ends. A prospective engineer acquires mathematical training as a basis for future use in his profession. Clear it is that the conditions here overlap in many cases the motive for the formation of associations, but we allow in this separate division for many conditioning motives, as in the illustration of the engineering student. (*g*) Whether an act is pleasant or the opposite, determines in great measure whether and how soon given associations will be made. (*h*) And as a last condition in influencing the connection of responses and stimuli we may name the motive of self-aggrandizement and self-satisfaction through the influence of which many associations are made and the acquisition of reactions facilitated.

2. *Stimuli and Stimuli.*—(*a*) Exceedingly prominent as a condition for the association of stimuli is the similarity or other resemblance between things or persons. The resemblance then, is a basis for the substitution of one object or person for another in a memory, thought, or imagination action. Possibly the resemblance may be owing to a partial identity of the stimuli such as the possession by each of a particular color or some similarly shaped common element. Illustrative of this type of connection is the case in which upon observing an unknown person on the street we call out the name of a friend only to find that a single more or less pronounced resemblance was responsible for arousing in us what we may call a misplaced reaction. This elementary fact of association we may consider to lie at the basis of all highly developed forms of classification such as we find in the earlier stages of all science. To be more succinct, the complex classificatory behavior of science and its development into the activities of organizing phenomena has its roots in the concrete fact that we make the same or similar reactions to similar stimuli.

(*b*) Another very important condition for the association of stimuli is the existence between them of some definite form of relationship. Objects may be related in series of various description so that the appearance of one may serve to arouse responses associated with all or some of the other members of the series. Besides membership in series, objects and events may be related as causes and effects, antecedents and consequences. Personal relationships as father and son, husband and wife, brother and sister, etc., may be the condition for the reaction of the person to an absent stimulus when the associated stimulus is present. What we mean by insight into and knowledge of things and processes is the development of expectancies and predictional capacities for events when their related phenomena are present.

(*c*) Meriting separate discussion is the connection of things or events because of the fact that stimuli-objects impress themselves upon us as signs for a thing or event signified. Through the connection of objects as possible symbolic representations of one by another we acquire our capacities to use objects needed as instruments of adaptation to conditions, but which are not now within actual reach. Here we find one of the prominent bases for all the higher forms of intelligent behavior, for in the symbolic relations of things we already have an elaborate interconnection of actions with combinations of stimuli-objects.

(*d*) Just as in the case of the association of stimuli and responses so here we find also that the frequency of connection between two objects or persons is conducive to the operation of one as a substitution stimulus for the other, and in consequence enlarges the scope and increases the effectiveness of our action.

(*e*) Recency serves likewise in this situation to connect objects and events, although the condition is limited in its potency to bring about serviceable connection.

(*f*) And finally as a contributing condition to the organization of connections of stimuli we might add contiguity or the sheer and accidental connection between objects, events or persons.

3. *Responses and Responses.*—(*a*) In the association of responses the frequency of connection is a very effective condition for the establishment of a relationship. This fact is illustrated by the rule of much practice for the acquisition of informational and skill responses. (*b*) Similarly recency operates as a condition for bringing together in more or less permanent form the members of a series of responses. When manual or verbal responses are in question then (*c*) rhythm is a patent factor in the formation of connections. (*d*) In the connection of verbal responses sound similarity is very important in many cases for the establishment of a connection which may resolve itself into actual rhythm. When we consider such associations as language responses we cannot over-

look the great importance of (*e*) custom and usage in the formation of response connections as well as in their dissociation.

4. *Stimuli and Settings.*—Significant as conditions for the establishment and continuation of these associations are (*a*) the sheer location of a stimulus object in its particular surroundings, and (*b*) the constancy of the location and connections between the stimulating factors.

5. *Responses and Settings.*—This type of association would clearly be conditioned by the same factors as (1).

6. *Settings and Settings.*—Whatever seems effective for (2) would appear to operate in this case also, although the connections here are not ever so clear cut or so permanent as in the case of the connections between stimuli and stimuli.

As a summary of this section we might suggest that our extensive, though certainly not exhaustive enumeration of the conditions surrounding the establishment of the various forms of association connections serves energetically to emphasize the individual direction of such connections. We mean to stress the fact that each associative connection, whether fortuitous or designed, casual or deliberate, is a unique fact and in consequence is a member among innumerable classes of events. Definitely, we mean to deny that there is a law or series of laws which can be considered either as a general statement of what brings about association or as a limited series of particular conditions exclusively contributing to the formation of associational connections. As we view the matter there are as many laws of association, if we insist upon the use of the phrase, as there are actual connections of psychological facts. This way of looking at the data of association constitutes merely a suggestion of the original character of all psychological phenomena and especially of human reactions.

V. *The Operation of Association Processes.*—Strictly speaking, the mechanism of association includes both (1) the processes of organizing connections between stimuli and acts, and (2) the operation of those reactions when formed. In fact, these two processes are simply reciprocal phases of a single mode of behavior, although for practical purposes they may be treated apart. In many cases, however, as we have already seen, the two processes are not readily observable, since the fact of having formed certain connections is evidenced only by the fact of using them as in recalling a name or in the performance of skilled acts as repairing a piece of apparatus.

While the simplest associational operations consist merely of the functioning of a reaction system or a pattern of such reaction systems when the connected stimulus appears, the most striking and effective are those mechanisms in which the reactions of the person are brought into play by indirect stimulation, that is to say, through the mediation of a substitution stimulus. The importance of the substitution of one stimulus for another may readily be inferred from the fact that all complex delayed reaction consists of the operation of some response to an object or person other than the object or person which stimulated the individual to act. By the term complex delayed behavior we mean to distinguish the so-called ideational and memorial reactions from the simpler reactions which for only very brief periods are delayed from operating through their temporary replacement by orientation postures and attitudes, such as the crouching movements of the cat in anticipation of the appearance of its prey, or other similar forms of behavior. As compared with these simpler reactions the complex delayed reactions may in general be considered as the basis for all higher forms of intelligent conduct.

Typical functioning of the complex associational processes may be observed in memorial behavior, since our memory activities consist practically in the operation of reaction systems excited to action by means of substitution stimuli originally connected in some way with the object substituted for. Possibly this associational reaction may be even better observed in the study of language and reading reactions. In these forms of behavior sounds or printed symbols serve as substitution stimuli to arouse overt or implicit reactions to whatever objects or persons are symbolized. Essentially, we repeat, the machinery of complex behavior is the interconnection between a given reaction of the person and two stimuli, one the original object to which the reaction is developed, called the adjustment stimulus, the other, any related object which can call out the reaction in question.

But here we may well pause and ask whether we are not unintentionally overdoing our argument concerning the prevalence and importance of association. Specifically, we may ask whether, in fact, an implicit action or idea can be associated either with an adjustment or a substitution stimulus. Our answer to the question is unequivocally affirmative and this answer we give because we believe ideational association is in essence a process of living over some past situation.[1] It is a process of repeating in an implicit manner some previous action. Possibly this point is most effectively illustrated in the observation that the process of recall which may be either an overt or an implicit act is merely the operation of a postponed reaction. My recalling an engagement may involve the overt act of immediately walking toward a certain point stimulated by the visual perception of my memorandum book, or it may be merely an act of determining and planning to go there induced by the same stimulus. Possibly it is not inadvisable to interpret the postponed act at the time of its actual operation as a substituted act, especially if we keep in mind the difference between it and the replacement acts mentioned above. Whether the postponed act is overt or implicit the event consists of a delayed response made possible by the connection of reactions with stimuli.

No better can we observe the operation of association than in the study of learning, for as a psychological process learning consists of the active connection of responses both overt and implicit, with specific stimuli. The overt responses may be manual or verbal, while the implicit reactions may involve any kind of indirect response to stimuli. When the responses are entirely indirect some actual contact between

[1] *Cf.* Kantor, 'An Objective Interpretation of Meanings,' *Amer. J. of Psychol.*, 1921, **32**, 231–248.

the person and his surroundings is maintained, of course, through perceptual activities. We assume the learning to be accomplished when the associations are so firmly established that whatever reaction systems are acquired will operate whenever their appropriate stimuli are presented. Now when a person in his various contacts with his surroundings has made many associations between his responses and stimuli we may truthfully speak of his capacities to do various things, for not only is he equipped to respond definitely and directly to particular stimuli, but also by virtue of having made a large number of associations, he is equipped to meet new situations, situations exactly like which he has never faced before, provided always, however, that conditions common to older circumstances are present. Learning and the capacities to which the process gives rise consist of the postponed operation of a reaction to a stimulus with which it has previously been connected.

For the most part it holds true that our intellectual and manual capacities depend directly upon the development of associations through actual contact with particular objects and conditions. Inventive skill, the ability to discern relationships in things, as well as expertness of judgment in given situations can all be readily traced back to frequent and constant association with the objects and events in which the person excels. In many cases what appears as a mysterious intuitive faculty can be shown to have its direct origin in such preoccupation with particular facts. Was not the discovery of the table of periodic relationships between chemical elements based upon such associational facts and are not mathematical discoveries and the capacity to classify animals rooted in the same associational soil?

Digressing a moment we might point out that the study of association as a basic and universal form of behavior throws light upon the extremely important problem of psychological capacity. Note that by capacity we always refer to an action, although it may be a potential or possible action. Now a potential action in psychology is merely a postponed or delayed response, postponed we say because the action was really started when the original association between stimulus and response was formed. My capacity to multiply, to play the piano and to draw, affirms the fact that I have acquired such associational connections between responses and stimuli; so that now the presentation of stimuli elicits their characteristic responses. By the same token the acquisition of many definite responses to particular stimuli leads also to the formation of more general and formal phases of action, and so we acquire general drawing, multiplying, and other capacities as well as the specific capacities to draw particular pictures or to multiply particular integers.

Observe then, that the general capacities refer to such phases of actual behavior as are common to all particular acts of a certain type. When we have multiplied enough pairs of integers and composed enough particular musical forms, we can thereafter multiply new combinations of integers and compose other pieces, but neither of these new activities will involve absolutely new factors; rather they will comprise individual and common behavior elements which have previously been associated. The less specific aspects of behavior give us then only relatively general capacities. That our so-called capacities are significantly rooted in previously acquired associations we note from the fact that it is extremely difficult to modify the capacities we already possess, such as dispensing with or changing our "styles" in handwriting, literary and musical composition and other ways of responding to stimuli. That all our capacities consist of associational connections is further indicated by the fact that we can change our styles only by training and in general finding new stimuli. Because the psychological data, at least of the human domain, involve so many and so wide a range of capacities and tendencies, we may consider our present discussion as offering additional evidence for the universality and foundational character of the association processes.

The associational processes, however, do not only constitute the main operational machinery for intelligent behavior, but the number and variety of associational reactions acquired determine also the differing qualities of high grade acts. Thus, the difference between merely knowing and originating within the domain of intelligent behavior is determined by the different associational mechanisms involved. In informational and other knowing reactions the substituted stimuli are very similar to the original ones, while in originating acts the effectiveness of the behavior depends upon the quantity and differences of stimuli that make behavior substitutions possible.

Possibly not too redundant is it to repeat again that the operation of previously acquired associations not only constitutes the higher intelligent reactions but also the simpler intelligence acts and capacities as well as behavior not specifically designated as intelligent. Especially must we observe that our passions, diffuse feelings and other types of affective behavior operate as they do in specific instances and bring about conditions in the relations between persons and their surroundings precisely through the same sort of associational machinery as we find operating in the so-called motor and ideational reactions. Now since the operation of associations always involves some specific type of adjustmental response we propose to discuss the associational mechanisms in a few typical situations.

1. *The Mechanism of Association in Manual Skill.*—How well the expert designer can plan a bridge depends entirely upon the suggestions his original data offer for the specific development of suitable structures and the harmonization of cost, appearance, solidity, and usefulness in the total construction. The specific workings of these suggestions consist of the substitution of the present data such as kind and location of site, and the needs of the situation for types of structures already built, studied, or projected. At each point in the work stimuli in the form of unwritten or spoken instructions, drawings, maps, plans, and instruments serve as substitution stimuli for reactions to detailed features of the whole situation. To take a simpler case of skilled behavior, the particular difficulties in the mechanism of an automobile, for instance, suggest other difficulties in other situations, or

ways in which the difficulties were overcome. In both cases of suggestion the substitution stimuli operate by calling out in the person implicit responses. Indeed, unless the present difficulties call out such reactions in the person no act of skill is possible, and the amount of skill possessed, that is, the number of successful operations, is an index to the number of associations previously made, excluding of course the associations being made at the time.

A similar operation of interconnected stimuli and responses providing the organism with orienting behavior is illustrated by animal reactions. A young pigeon making its first flight from the cote can be easily caught because it has not associated its reactions with specific surrounding objects and places of possible safety.[1]

2. *The Mechanism of Association in Memory.*—In memorial behavior the associations operate in two main ways. (*a*) Through them projected reactions are possible in the sense that substitution stimuli are intentionally attached to acts for the purpose of postponing some work or other action. The substituted stimuli may be time, as when we agree to do something at a given point in the future. In this case we would mark our calendar as the effective means of stimulation, or we may promise to speak to someone when we meet him. In this case we project an action into the future by means of words. Probably it is well to point out that here we have an action in which an indirect or implicit response occurs before the direct one, although in every case, of course, the direct association must have been previously made.

(*b*) The recalling of forgotten events or the performance of forgotten actions is brought about by almost any kind of object or situation, provided it has previously been connected with the forgotten event or act. The appearance of a certain person may be the stimulus for the act of paying the arrears in dues to the club to which the person had introduced us. In this case the specific mechanism is not controlled by the person and the act is unintentionally delayed, perhaps to the chagrin of the reacting person.

[1] See Whitman, 'Orthogenetic Evolution in Pigeons,' 3; 'The Behavior of Pigeons,' 1919, 157, edited by Carr.

3. *The Mechanism of Association in Imagination.*—In imagination reactions the associations between things serve as stimuli to suggest to the person associations between other things; so that the latter can be recombined and rearranged in various ways besides dissociated and reconnected with other things, persons, or events. In this type of reaction the fact of association or other relation between things serves as the effective stimulus to new forms of implicit behavior. Here as in other cases the efficiency of the person depends upon the number of previous associations actually formed; in other words the imaginal capacity depends upon the amount and degree of practice.

4. *The Mechanism of Association in Thinking.*—Thinking acts, involving as they do intimate responses to problematic situations, exhibit a multiplicity of forms of associational operation. In the first place, the capacity of the thinker depends upon the number of solutional ideas suggested to him by any problematic situation. As in all the other cases this suggestion is a function of the number of previous associations the person has already made with similar objects and conditions. How many associations are necessary may be readily estimated when we consider that each thought activity constitutes a unique behavior situation.

Throughout the entire series of complex association mechanisms there runs a common principle, namely, that such mechanisms enable the individual to perform a multiplicity of responses or at least suggest the possibility of multiple responses to a few or all of the immediately present objects or situations. This result is made possible as we have seen by the organization and reorganization of stimuli and responses.

VI. *The Modes of Psychological Association.*—Almost obvious it appears that such a constant and pervasive phenomenon as association is, will exhibit a variety of forms in the various behavior circumstances of individuals. We have already met with some of these varying modes in our discussion so far, but for purposes of further explication and in spite of repetition we may enumerate the following modes of association.

1. *Primary and Secondary Association.*—In the stimulus-response connections we find reactions which are originally connected with certain stimuli as in the case of a bit of meat serving as the stimulus for the salivary reflex action. Now when this reflex is conditioned we assume that the responses are attached to some other form of stimulus as the sound of a bell or an odor. The first connection accordingly we will call primary, and any succeeding connection may be called secondary, tertiary, etc., to the limit of associational capacity. Naturally, this classification will have to be mainly confined to simple forms of response, for only in the simple forms of behavior can we definitely determine what are original stimuli and only in such cases can we observe the appropriation by another or an additional object of the rôle of an inciter to action. No doubt, exists, however, that this process of transconnection between stimuli and responses is a common occurrence in our most complex behavior.

2. *Temporary and Inseparable Association.*—Another mode of association refers to the relative permanence of the connections when formed. Probably most of these connections when made between stimuli and responses or between stimuli persist indefinitely, although some associations become dissolved in the course of a longer or shorter time. Every case of forgetting or the loss of skill of any sort involves the dissolution of some connection between associated members whether responses or stimuli. Language connections exhibit many illustrations of inseparable associations which apparently should be dissolved. Thus sunrise and sunset persist as names for events which we know do not occur. Again, the expressions about the lack of brains or good brains survive in spite of intelligent information concerning psychological activity. Every person who is troubled about his own or some other person's bad habits knows the difficulties of disconnecting reaction associates.

3. *Original and Formed Associations.*—Of the connections between responses some are original associations necessary for the occurrence of given adjustments to stimuli. As such we may mention the movements constituting the combina-

tions of reflexes and the integrations of response factors in habits. Among the formed associations we may classify the organization of series of responses as nonsense syllables and various language connections, although in some cases of language reactions, notably where articles are inseparably connected with names as in the German language, we may consider such associations as original. The criterion we are using in this particular classification may be considered then to be (1) the degree of deliberateness with which the associations are formed when the individual forms them, and (2) the question whether the individual is responsible for the connection or whether the adjustments are socially dictated.

4. *Logical and Conventional Association.*—A fairly broad and sweeping distinction can be made between logical connections existing between responses and stimuli, and those based upon pure convention. Most associations which we form through the direct influence of the stimuli-objects themselves will illustrate the logical type of association. When we jump out of the path of an automobile we may justify speaking of such a response as a logical adjustment to the stimulus. Quite otherwise is it with another large mass of our responses. Attaching a sex name to a ship or gun is in no sense a logical association but merely customary. The domain of language is full of such illustrations of the logical and conventional associations. This distinction of logical and customary connections is likewise illustrated in our responses to sound. We speak of high and low, hard and soft tones, when as a matter of fact the names or descriptions given to such sounds are arbitrary and in many cases illogical.

5. *Direct and Indirect Association.*—As our last mode of association we may name the direct and indirect connections. As direct we may consider any immediate connection of associational members usually made possible by the fact that the person is in direct contact with the stimulating object when stimulus-response connections are formed. On the other hand, indirect associations are such as involve the intervention of a third factor when two members are associated. Direct associations are exemplified by the infant's

development of a withdrawal reaction by being burnt in the candle flame, while the indirect association is exemplified by acquiring informational responses to a foreign country by means of a geographical atlas. Indirect language associations are illustrated by the names we give to objects because of a resemblance in appearance, use or sound. Thus, we use the word glasses for spectacles, binoculars, or drinking glasses. Possibly the largest number of our indirect associations involve language and informational responses, for notice that all fixed figures of speech involve the indirect mode of association. When the indirect associations are not linguistic we find that in most cases they are formed because of the inaccessibility of the objects; so that the original contacts with them are brought about by reading of them or indirectly hearing about them.

Our discussion of these five modes of association offers conclusive evidence of the fragmentary character of the enumeration. Not only is it not practicable to enumerate all of the modes of association, but even in these five there is much overlapping. Again, it is not easy to hit upon a single criterion or even a few criteria upon which to base the enumeration. And so we have not attempted to distinguish between individual and social association, or between the formation, existence, and use of association. Just why an exhaustive inventory of all or most of the modes of association falls without the limits of wise undertakings, is found we believe in our much reiterated remark that association as a psychological process is a universal factor in all psychological behavior.

VII. *Levels of Associative Formation.*—From the fundamental and pervasive nature of association we may readily infer that the connections between the organism and its stimuli, as also the organization of responses themselves, take place upon every conceivable level of activity. If we start with the earliest elementary forms of connection between stimuli and responses such as constitute the basis of differential behavior and psychological activity in general we may say that the lowest association level is found in the biological maturation of the organism. As a definite example of associative connection at this level we may proffer the case of reflex action, for we believe that the organization of response factors for the most part takes place during the intrauterine life of the person. Also, we might indicate, although this point is not wholly without ambiguity, that in the early weeks of postuterine development the connections between reflex acts and their stimuli take place.

To consider now associations formed during the individual's more active contacts with his surroundings we may note that many of them are developed without any intention of the person and in many cases without his knowledge. Illustrative of such situations are the cases of the infant who forms all sorts of reactional connections with the objects stimulating him besides acquiring many language responses through contact with persons who use that language. In both cases the infants may be said to have the associations made for them although they are by no means passive participants in the situations.

On the other hand, in active learning of all sorts associations are formed with the knowledge and consent of the person. At this level the individual is far more active in the organization of responses to stimuli or in the formation of connections between acts. When we learn to drive an automobile or operate any kind of new mechanism, or when we attempt to acquire any kind of book learning, we deliberately form associations for our own purposes.

Possibly the most complex and highest level in the formation of associations is the critical one of science. Here are developed the most definite forms of associations between the investigator and the objects which he studies. Because of the scientist's interest in the causal connection between things he must make abstract and very indirect associations. Clearer appears this point from the observations of things or inferences from those observations. Many scientific associations are of course the symbolization of the connections which the scientist discovers to exist between objects and events in nature. But in equally as many cases the relations between things are so obscure and difficult to get hold of that a very indirect method of knowing them must be utilized.

VIII. *General Conditions of Association.*—Besides the specific conditions for the formation and operation of association which our discussion has brought out, a number of general conditions determine the kind, number and strength of connections which are formed.

Obviously, one of the most prominent of the general conditions must be the opportunities to form associations. In other words, the larger the number of our contacts with objects the larger is the number of reactions we build up with which to adjust ourselves to them. Likewise the greater the variety of things and events which affect us, the greater will be the number and types of our associations. Practically speaking we must, in order to develop many and various associations, visit new surroundings or have them brought to us through descriptions.

An equally influential condition for the formation of associations consists in the social surroundings of the person. The customs of the groups in which one lives are potent determiners of the behavior development of the individual, prescribing as they do what one shall learn, as well as determining what we must and must not do.

For the operation of association much the same conditions prevail. The more objects we are in contact with which can serve as adjustment or substitution stimuli for responses which we have acquired, the more likely is it that the responses will be elicited. And let us not neglect to consider the effect of the present attainment of the person upon his association formations. Skill and knowledge reactions depend for their development upon the present information and ability of the individual. We all know that the more information one has upon any subject the easier it is to acquire more. Similarly, the acquisition of specific sorts of associations develops a line of less resistance for the further development of associations in that general direction; the ground is prepared for definite interests and urges to do certain things and to develop desired behavior connections. On the other hand, such acquisitions inhibit and interfere with the formation and operation of certain other associations. To possess particular prejudices means we will be prevented from indulging in certain activities and acquiring associations of specific sorts. The inhibitory effect of previously acquired associations even goes so far as to prevent us from performing actions which under the circumstances would be especially desirable or effective.

Of no slight importance for the formation and operation of associational connections is the general health condition of the person, and this extends to the matter of fatigue also. These points, however, it is unnecessary to stress, since they are operative with equal force in all cases and in all phases of behavior.

Manifestly, a general condition for the development and use of associations is practice. Without practice the acquisition and fixing of skill and informational responses would be an impossibility and certainly when associations are formed their use is greatly facilitated by constant and frequent exercise.

Finally, we have to consider the normality of an individual with respect to his associational reactions. If for any reason he is below par in his functional capacities he becomes disoriented, that is to say, his associates become dissolved and he loses contact with his surroundings. As a record of fact, the dissolution of association which we call disorientation is one of the most prominent symptoms of psychological disorder and disability. From the nature of association this is, of course, precisely what we would expect. In many cases, too, the disorientation may be owing to the stimuli factors, with the consequence that it is entirely possible that the disorientation or the lack of associative connections is itself the abnormality. Hysterical blindness, deafness, etc., are dissociations of this type, although they are frequently connected with other untoward conditions of the person and are not the result entirely of overwhelming external circumstances.

IX. *Psychological Association and the Neuronic Theory.*—Perhaps as a final indication of the character of psychological association we might make clear the point that the process of association refers exclusively to the immediate or mediate connections between the acts of the person and surrounding stimuli. The term mediate connection refers to the associations in which series of responses are connected of which perhaps one or only a few members are in direct linkage with stimuli. What we wish especially to make plain is that the stimuli and responses are the end and sole factors in association. That is to say, association consists of the various organizations of these factors. What follows then is that we may not think of the connection between stimuli and responses or between responses and responses as the manifestations of something else.

Frankly, we want to deny that the connections between associational members are the manifestations or effects of connections between neurons or neural patterns. Further, we might go in our disavowal and say that we cannot accept anything of a neural basis for association. In opposition to the neural theory a number of objections may be strongly urged.

In the first place, to assume a neural basis for association means to distort associational facts in two particulars. (1) The function and efficiency of the stimulating situations and objects are set aside and not given place or prominence in the description of the associational facts. Besides preventing us from correctly describing the facts of association such a procedure inevitably misleads us into limiting the number and varieties of association to accommodate the theory. It is not improbable that to the neural theory may be laid the charge of excluding from associational types all the connections but those of ideas and sensations.

(2) No less serious objection to the neural theory is the criticism that its upholders attempt to make some phase or a part of one of the members of an associated couple a causal condition of the connection. More and more widely recognized is it becoming that we must not look upon the neural phases of psychological action as anything but integral factors of a total reaction. Now it is plain enough that even

when we are discussing associations between reaction couples we blunder by taking the neural components of one or both members as causing or conditioning factors. How much more culpable is it then when one or more members of the associated complex are stimulating objects or situations. Precisely how serious is this present criticism may be judged from the fact that when we maximize the importance of the neural factors in behavior we thereby submit the reactions to needless diremption, separating the neural activities from the many other components. And usually we follow up such descriptions by calling the neural mechanism an intervening process between the stimulus and the response, the response here being of course the remaining processes of the single adjustment act.

(*b*) Further, from the standpoint of an organismic psychology, the neural theory of association stands condemned because it perpetuates the doctrine of autonomous mental states. Instead of allowing psychological phenomena to be described as definite concrete reactions of the individual to his surrounding stimuli, the neural assumption presupposes that psychology is dealing with mental or psychic states for the existence of which the nervous system provides a basis and for the organization and operation of which the nervous system constitutes the mechanism. Whether we accept or reject a psychology of mental states we still face the problem whether the process of association is confined to the connection of simple units of a complex mind or state of mind, or whether the process includes also the connections of responses with stimuli, an addition which may be expanded to include the general interconnection of persons with their surroundings. A crucial problem is here involved affecting the very foundations of psychological science.

(*c*) From the actual development of psychology we learn that the insistence upon a neural basis and mechanism for psychological association involves a very doubtful procedure, namely the attempted correlation of specific neural elements with particular ideas or other mental states. How manifestly erroneous such a procedure is, is readily indicated by the denial of every psychologist that he is really attempting such a correlation. No psychologist, it is safe to say, would care to admit that he means to connect an idea with a specific neural element; but is this not the inevitable implication of a neural theory? From the earliest correlation of neural and mental phenomena the aim of psychologists has been to make use of the neural apparatus to account for the organization and association of mental states; and how, we may ask, could this desired effect be brought about unless specific neurons were connected with specific mental states? Of a certainty this entire procedure is very vague and without the slightest shred of support from competent neurologists, and yet the aim of the psychologists although denied by them is indubitable.

What follows if the psychologist does not attempt an exact correlation between neural and mental elements? Simply this, that the nervous system is clearly neither a mechanism nor a basis for association or any other kind of psychological process. As we have more than once indicated, the neural theory not only does not help us at all in the interpretation of associational facts but it precludes our investigating the neural mechanisms themselves as integrant factors of complex reaction systems.

X. *Summary.*—Precisely as in the case of an earlier psychological period associational processes today may be looked upon as fundamental and universal mechanisms for all psychological phenomena. But unlike the earlier period in which association was considered as having to do only with mental states, we must today consider it as referring to the organization of actual stimuli-response situations. Associational processes, then, we may conclude constitute some of the basic facts in an objective and naturalistic psychology. We have attempted to point out that the specific reactions to stimuli such as we call learning, remembering, thinking, and the manipulation of skill are all the operations of connections between stimuli and responses. Also, psychological capacities of various sorts besides specific responses may be looked upon as the association of many responses and stimuli of some given type, all of which in their operation give the person a series of general competencies serviceable in his various adjustments.

Now just in this fact that we can find common ground in such apparently widely separated psychological positions as associationism and objective psychology do we find support for the validity of our hypothesis that association is a fundamental basis for all behavior. Let us observe that after all the associationists may be considered as having magnified a single kind of associational process, namely connections between implicit responses. Our study, however, has sufficiently indicated that from an objective standpoint we must, along with the response factor, include the stimulus phase of a behavior situation as an essential factor also, no matter how many reaction systems are associated in a pattern of response to form the reaction phase connected with the particular stimulus. Since associational processes are in the last analysis orientation processes connecting the organism with its various surroundings, we must include among the types of stimuli studied the objects, events, and persons which arouse the individual to action.

Associational processes we have found to include always two phases, one the organization of stimulus and response connections, and the other the subsequent operation of the responses when the previously associated stimuli are presented. To a very slight degree then we might correlate the organizational phases of association with the simultaneous association and the operational aspects with successive associational phenomena.

Since we look upon associational facts as definite reactional processes we do not expect to find a few "laws" governing the operation of associational mechanisms. Innumerable contributing conditions accompany of course both the acquisition of associational connections and their subsequent functioning, but none of these is in any sense a directing principle of the connections between stimuli and responses. In contrast to directing principles or laws the conditions of association connection are the facts obtained in empirical observation concerning some actual association. Similarly what we have called modes and levels of associations are designed to bring out specific empirical association features.

And finally, we conclude that if the facts of association are definite responses of organisms to their surrounding stimuli, then we can in no sense look upon any phase of the response such as the nervous apparatus as the cause or condition of the associational connection. In the first place, no such causal means of explanation is required to account for the facts of association, and in the second place, it would be impossible to give any causal explanation in terms of the neural mechanisms of the response factor. For our own part, we are content with our description when we give an account of the interconnection of stimuli and responses with the circumstances attending such an interconnection.

SENSATION, IMAGINATION AND CONSCIOUSNESS[1]

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Our scientific concepts generally are in the melting-pot. They are all infected by relativity. This is as true in psychology and philosophy as in the physical sciences. In each case we must be willing to reconstruct our concepts on the basis of new evidence. Psychology has too long been hampered by a false tradition, and incidentally it has dragged philosophy with it into the slough of subjectivism. Brilliant discoveries in the realms of physiology and pathology throw new light on many of the fundamental concepts of psychology, spite of the fact that the investigators themselves have sometimes been misled by the old tradition. We are here concerned with their data, not with their theories. The evidence, as I interpret it, gives the death-blow to the old subjectivistic psychology. As regards sensations, the evidence shows, on the one hand, that their character is independent of consciousness; but, on the other hand, it equally disproves the assumption that the sense-qualities exist in the physical world just as we know them and independently of the organism. The evidence further shows that the centers of the central nervous system constitute a hierarchy of energy patterns, not storehouses or factories of content, sensational or imaginal. The content is due to lines of motion, connecting those energy patterns with the sense-organs. The processes of selection, suppression, and integration at the various levels of the nervous system are due, not to consciousness, but to the characteristic energy patterns of these levels. There is no reason to limit consciousness to any particular level, though we can have evidence of it only in connection with one type of pattern, viz., meaning patterns. What con-

[1] This paper was read before the Psychological Society of Cambridge University March 2d, 1921, and before the Philosophical Society of Oxford University, March 12th.

sciousness contributes in connection with the various energy patterns and their excitement is the bare fact of awareness. It is not an explanatory principle. Furthermore, so long as we regard the individual in the abstract, we do not require the concept of mind.[1] We can explain behavior in terms of neural patterns and their stimulation. It is only when we take account of social relations that we find it necessary to introduce mind. In neither case do we invoke consciousness as a principle of explanation. With this brief introduction, we shall now proceed to the examination of the evidence.

The Nature of Sense Qualities

In the annals of psychology nothing more heroic has been recorded than Dr. Head's subjecting himself to vivisection in cutting certain nerves that supply the superficial organs of cutaneous sensation.[2] The evidence thus arrived at has been corroborated by a mass of pathological cases, especially from the late war. The evidence is so familiar that it will only be necessary to state it in outline. The elimination of the functioning of the superficial organs strips bare the deeper sensibility and reveals its quality. These deeper organs of muscles, joints, and tendons respond to pressure and to pain. They furnish a fairly accurate localization in space. And it is they which furnish the impressions which when conducted to the cortical field, give us the sense of passive posture or three-dimensional space.

When recovery begins to take place, the primitive punctate or protopathic system becomes active and confuses the process of localization. The protopathic system responds, through its punctate organs, to pressure, hot and cold, and pain. But its responses are diffuse, massive and primarily affective. It informs us, not of the qualities of things, but of how stimuli affect the organism. It centers in the optic

[1] So-called individual psychology has as a matter of fact not been individual. It has studied the reactions of the group-individual, though it has ignored the significance of the group in explaining conduct.

[2] For a summary of the epoch-making work of Dr. Henry Head, with Dr. W. H. R. Rivers and other collaborators, see Dr. Head's article, 'Sensation and the Cerebral Cortex,' *Brain*, 41, Part II.

thalamus rather than the cortex. It is adapted for defensive withdrawal of the body, not for differential reaction having reference to the part affected. Its responses are crude and non-discriminative. It is characterized by the 'all or none' reaction. It responds to extensity of stimulation, not to graduated intensity. Nor does it respond to localized stimulation. The stimulations radiate to distant parts. They lack control. It cannot discriminate the two points of the compass. It is different when the healing process is complete and the epicritic system appears. This superimposes control upon the crude mass response of the protopathic system. The sense stimulation no longer spreads to distant parts. We can now project points, *i.e.*, respond to the locality stimulated. The 'all or none' type of reaction disappears and the response is approximately graded according to variations in intensity. We can now take account of the physical qualities of things as well as the affective qualities. We can discriminate simultaneous and successive points in two-dimensional space. Adaptation, which is absent on the protopathic level, returns. All this of course presupposes the intactness of the central nervous system. The epicritic system is ultimately centered in the cortex, as the protopathic in the optic thalamus.

The sense-organs are characterized by structural differentiation, and upon their reaction to external stimuli depend in the last analysis the different sense qualities. We cannot follow the assumption that these qualities are merely transmitted from the external world. If we compare the sense organs to resonators, they are at any rate not neutral resonators, but contribute a differential quality of their own. They are specific energies. The cold spots will respond to temperatures below 22° C. with a characteristic cold quality. But they will also respond, in the absence of inhibition from the hot-spots, with an ice-cold sensation to temperatures of 45° C., which when applied to the hot-spots or the general surface give us a sensation of pleasant warmth. In the absence of the functioning of the cold-spots, the hot-spots respond to stimuli of 22° C. with a characteristic warm sensation. Sensations, in other words, are compound energies. They depend, to be sure, on the character of the stimulus, but they depend also on the energy complex of the sense-organs. This is especially evident in the case of the chemical senses which at any rate include all but hearing, if not the latter. It is as absurd to suppose that the physical vibrations, which our physical instruments reveal, are red or green, as to suppose that they are cold or painful. It happens that we carry a polychromatic camera in our heads. But we can also construct polychromatic cameras that can see colors. Neither the cameras in our heads nor the artificial cameras can see color unless they possess the specific energies to respond in a characteristic way. Sensations are ordinarily physico-physiological processes, though they can, under certain conditions, be produced by the organism independently of the physical stimulus. We have no evidence that they can be produced in the absence of the specific conditions furnished by the sense-organs or similar organs. Even in the case of sound, though we carry a harp in our ears, be it the basilar membrane or some other organs, we know that harps respond with a quality of their own. Sounds, too, are compound energies.

While we hold to the specific energies of the senses, this does not mean that sensations are transmitted to the cortex just as they result from the reaction of the senses. The evidence of Dr. Head and others shows that the crude sensations undergo selective analysis and new integrations on the way to the cortex. This, however, does not necessarily mean a change of specific quality. We are not in a position to dogmatize about the difference which the various neural patterns make to the sensory impulses as they are permitted to pass the hierarchy of 'vigilances.'[1] But, at any rate as regards the cortical field, pathological evidence goes to show that there is no raising of the threshold unless the cortical injury be very extensive. The difference between the normal reactions and the pathological may be reduced to one of

[1] The term 'vigilance' as used in this connection by Dr. Head has no anthropomorphic significance.

'clearness.' There is a lack of 'clearness,' 'pointedness,' 'sharpness' in the case of a cortical lesion affecting certain parts. This leads to uncertainty, hesitation, guessing, and hallucination. It is a failure in discrimination or a difference in attention. What holds on the cortical level probably holds in the case of the neural levels below it and their pattern reactions. In any case there is no reason to suppose that the characteristic qualities of sense-impulses are altered. And what is true of sense-impulses, holds equally of affective qualities. While the optic thalamus seems to be peculiarly the center of these qualities, the discrimination of intensive graduation within these qualities and their weaving into the complex patterns of emotions and sentiments, with their objective reference, must be peculiarly the work of the cortex. In any case the affective qualities do not owe their nature to consciousness.

Selection and Integration in Terms of Neural Levels

If the evidence disproves the subjectivistic interpretation of sensations, it no less breaks down the subjective view of the selection and integration of sensations. We can state the selective and integrative functions in purely physiological terms. They are present at all the levels of neural reaction and do not, any more than the data, owe their character to consciousness. We can thus give a physiological statement of the 'subject-object' relation. For the subject relation means the selection of data with reference to certain ends, whether these ends are ingrained in our nervous structure as a result of biological heredity or are further elaborated in terms of the life history of the individual. Obviously the first subject reactions must be biological, as individual history must start somewhere; but throughout individual history our selective activity is fundamentally determined by biological patterns, however much overlaid by individual experience. At each level of the nervous system, selection is conditioned by the unique neural pattern of that level as it is organized in terms of race and individual history. The object consists of the afferent impulses which are selected and integrated by the pattern, or rather hierarchy of patterns, and which thus become effective in guiding conduct. The afferent impulses may figure as part of either the subject relation or object relation. They are part of the object relation when they are selected as data to be integrated and acted upon. They are part of the subject relation in so far as they are the rebound of the selective activity and figure as part of its tension, as for example the motor sensations in active attention. They become, then, means of selection, not data which are selected.

Let us now try to make our meaning clearer by examining the functions of the central nervous system at various levels. The nervous system consists of a hierachy of fields of energy or controls. These fields must be thought of in physiological rather than in structural terms, though of course they have structure. The structure, however, is too complicated for us to follow its internal dynamics. It is fraught with a past of indefinite duration of which we know little. We must therefore be pragmatic and judge neural structures by their functions. While these energy fields differ vastly in complexity and in their characteristic patterns, they have certain essential characteristics in common. Their part is to select, sort into kinds, suppress incompatible impulses and facilitate compatible, and finally redirect or integrate these impulses so that they may be carried out in accordance with the needs of the organism. Their adaptation throughout is of the trial and error kind; and it is clear that natural selection has acted effectively to eliminate the conspicuous failures of nature's experimentation, even though natural selection as a purely negative agency is barren so far as producing adaptation is concerned.

The sorting process begins at the first synaptic junction in the spinal cord. The sensory impulses of hot, cold and pain cross to the other side and travel along separate secondary paths. The tactile impulses travel both along the posterior columns and along secondary paths as far as the top of the spinal cord before they all cross into secondary tracts. Like impulses are grouped together from all three systems—

epicritic, protopathic, and deeper sensibility. Thus the tactual sensations from the three systems are combined. Impulses of hot, cold, pressure and pain proceed along separate paths to the optic thalamus which is the center for the crude discrimination of these sensations, but especially the center for the affective qualities of comfort and discomfort. The three sensory qualities of space are bound up with the tactile impulses along the posterior columns of the spinal cord; but above it they follow each a separate path through the fillet of the optic thalamus to the cerebellum and cerebrum.

The cerebellum has to do with the control and regulation of the postural and tonic aspects of muscular activity which involves complex discriminations and adjustments, though we do not ordinarily associate consciousness with such activity. The cortex is the organ of objective cognition. On it depend, in the first place, the more delicate discriminations of data. It is only at the cortical level that we discriminate graduated intensities of stimuli. It is also the supreme organ for spatial discrimination in the three dimensions—point localization, discrimination in two-dimensional space, such as the two compass points, and the sense of posture. The last implies a cumulative sense of positional values, or what Dr. Head calls a schema, which, however, must be understood as a cortical pattern reaction and not a contribution by consciousness. The cortex discriminates the physical qualities of size, shape, weight, and texture and makes graduated comparisons possible within those qualities. It also has the capacity of recognizing a series of minute and vibratory differences, thus giving us our immediate sense of duration. With the recognition of sense differences goes the projection of lines of reference to the parts affected, without which the information conveyed would be of no practical value, and this capacity depends primarily upon the cortex.

Imagination Patterns and Sensations

The cortex is not only the great organ for objective discrimination but also the great organ for establishing relations between data. For this complex pattern reaction of the cortex, we may use the term meaning. Pathology[1] indicates a considerable specialization within the cortex for meaning reactions. The meaning of single words or names may exist when the propositional meaning of words is lost and *vice versa*. Both kinds of meaning are lost in deep semantic disorders. Meaning to a certain extent may exist spite of failure of verbal expression. The patient may still be able to point to things signified. However crude such recognition in the absence of language expression may be, it should give us pause from identifying meaning entirely with language mechanisms,[2] valuable though the latter are as instruments of meaning and indeed indispensable for its abstract elaboration. There is of course ample evidence for language mechanisms taking the place of thought, but then we no longer have the process of thinking.

It is evident that the great superiority of the cortex lies in the perspectives which the meaning patterns make possible. As it is equipped with the 'long distance receptors in space,' especially sight (as pointed out by Sherrington), so it is equipped with long distance receptors in time. While in the lower centers, such as those of the spinal cord, the past endures as condensed in their present structure, this responds only to present stimuli. The cortex, on the other hand, through its memory patterns can respond differentially to distant events in time. Again, through its anticipation patterns, it can project events into the future and build the bridge before coming to it. This hierarchy of relation patterns in the cortex, from the comparatively passive revival of past experience to the active reconstruction of experience to meet new events we shall call imagination. It is not necessary for our purpose to distinguish between imagination and thought. Or rather thought is one type of imagination. It is constructive imagination as contrasted with reproductive, though sometimes we limit thought to constructive imagina-

[1] See Dr. Henry Head's article, 'Disorders of Symbolic Thinking and Expression,' *Brit. J. of Psychol.*, 11, Pt. 2.

[2] Professor John Watson in his brilliant paper, 'Thinking and Language Mechanisms,' before the Oxford Congress of Philosophy, 1920, seems to identify thought entirely with language mechanisms.

tion which works with abstract symbols. This distinction has tended perhaps to draw the line too sharply between thought and artistic invention. Thought may work with concrete imagery, while artistic imagination may be singularly lacking in such material.

What I want to emphasize is that constructive imagination or thought is as genuine a type of neural pattern as is the reflex arc or the primitive instinct. In the absence of its specific cortical pattern, thought cannot be aroused any more than a reflex can be aroused in the absence of the specific neural pattern. You cannot make an idiot think, try as you may. Thought is not an instinct, as Graham Wallas intimates. It is a far more complicated pattern. It may be aroused by curiosity or any other instinctive activity; it may also be aroused by sensations. But it may act from its own peculiar restlessness, one thought process stimulating another. Thought is not to be regarded as a beast of burden of our lower propensities, as the anti-intellectualists maintain, though it may be evoked, and should be evoked, to guide and control the instincts. It may, however, work for its own creative satisfaction. Its bodily expression varies with temperament. It may be organic as in what Fouillée calls the 'sensitive temperament'; and then one can think best by lying flat on one's back; or it may be motor, and then one can think best by giving the large muscles play. It is essentially social, and so implies the need for expression of which language is an instinctive neural pattern.

And now we must say a word about images. The pathological evidence indicates that images play at most an unimportant part in behavior. Postural images may be present as vivid as ever in a cortical lesion on one side of the cerebrum, but such images are impotent to guide postural adjustment. They lead neither to effective recognition nor appropriate expression. Evidently images have been much over-rated by traditional psychology. But what are they? Since Galton there can be no doubt that there are marked differences in concrete types of imagination, *i.e.*, in the relation of imagination patterns to the different organs.

Some peoples' imagination relates more to the eyes, others' to the ears, etc. But this does not mean that the cortex fabricates a peculiar content, whether sensations or images, nor that it stores content. There is no more reason to suppose that the cortex stores or fabricates content than to suppose that the spinal cord does so. The neural centers of the various levels are systems of energy patterns of increasing complexity and uniqueness. They are not store-houses of content. What they store are lines of motion as potential energy. All content is sensational and exists only in the degree that the senses are active. All the real evidence points that way.

In the first place, it is impossible to distinguish between imaginative content and sensational content at the minimal level of intensities. This is what gives rise to the troublesome complication of 'expectant attention' in our experiments. If imaginative content had a unique quality, as some maintain, this confusion should not exist. We should no more confuse an image with its corresponding sensation than we confuse color with pressure, even at minimal intensities. In the second place, much at least of what has been supposed to be imaginative content is proved upon inspection to be sensational. This is particularly obvious in regard to motor imagination. But there is good reason to believe that it holds of all the types of content in imaginative activity. In the third place, we can arouse *bona fide* sensations through imagination. Imagine yourself riding on the back of a tiger, and you will find that you have veridic sensations of shiver all over. To a certain extent you can control the succession of color fields in the case of visual imagination when it is directed to producing color fields on the retina, and some experimenters claim to have complete control. Moreover, if you extrovert your attention in the case of a vivid visual image, you will find it on the retinal field. At least that has been my experience. Of course the pattern is cortical. A Scotch plaid would not happen by chance on the retinal field.

The anatomical mechanism, by which such sensational content is furnished, in the case of imaginative activities, is obscure for the most part. In the case of motor imagination the sensational content is sufficiently explained by the close connection between meaning patterns and expression patterns in the cortex. The sensational content is the afferent result of this arc. But we cannot see how the motor adjustment of the eye could give us anything but motor sensations. It could not account for the variety of visual patterns that imagination furnishes. And the same problem meets us in the other sense departments. There is, to be sure, a close connection between incipient articulation and internal hearing, but it hardly seems sufficient to account for the range of auditory values of a symphony, considering the limited range of our vocal organs. They couldn't very well supply what they cannot produce, though they no doubt are contributory. It has, however, been definitely proved that there are centrifugal sensory fibers running from the sensory centers of the cortex to the sense organs as well as centripetal sensory fibers from the sense-organs to the cortex.[1] Such centrifugal fibers have been found where they seemed least likely, viz., in the ear. We have here, it would seem, the required physiological mechanism to account for imaginative content.

We may hold, I think, that the imaginative patterns in the cortex are connected by lines of motion, centrifugal as well as centripetal, with the sense-organs of the body; that what is stored is not content but lines of motion, thus connecting the meaning patterns with the parts of the body; that imaginative revival means that these energy patterns are brought into play and communicate their motion outward to the sense-organs, which if the excitement is sufficient to overcome their inertia respond by sending sense impulses to

[1] 'Outlines of Psychology,' O. Külpe, trans. by Titchener, 3d Ed., 1909, pp. 84, 85. The evidence in regard to the eye to which Külpe refers has since been corroborated and extended to the other senses. Külpe uses the hypothesis of centrifugal sensory conduction to account for (1) the effect of inadequate stimulation upon the brain-stem; (2) the phenomena of after-sensation, *e.g.*, that an exclusively monocular stimulation gives rise to a sensation in the unstimulated eye; (3) the so-called positive after-image, a secondary sensation of the same quality as the primary sensation but occurring after a short pause; (4) certain facts in connection with 'centrally excited' sensations, such as illusions and hallucinations. He still holds to the hypothesis of cortically excited sensations, independent of the periphery, for the ordinary imaginal processes.

the cortex. Unusually high excitement in the cortex would tend to produce illusion and hallucination. We can thus account for the proof-reader's errors and for our supplying the pianissimo treble notes which the player only feigns supplying; and we can understand why people see life-size ghosts with clothes on, just as they expect or fear they will. Individual variations of permeability in the direction of certain sense-organs would account for the relative dominance or absence of certain types of imagery. The fact that images do not ordinarily come ready made but are the result of fixation by attention, voluntary or involuntary; that, moreover, they increase with attention in vividness and definiteness until they result, as they often do, in veridic, and not merely nascent sensations; that under such circumstances, if we are careful observers, we can notice a corresponding excitement in the sense-organs—all this fits in with the above theory. Cases of insistent images can be shown to be due to an insistent cortical pattern which has established unusual permeability for itself in a certain sensory direction. We can account for negative after-images, resulting from imagination, which, however rare, are now acknowledged to be veridic, *i.e.*, some observers in imagining red have succeeded in getting a negative after-image of green. The theory would also help to explain various phenomena of centrally initiated pain sensations, so familiar to the pathologist. But the psychological reader can easily multiply instances where the theory would be useful.

It is not difficult to account for what has been termed imageless thought on the above theory. In the first place, there is wide variation as regards the presence of concrete imagery and in some individuals it is largely absent. But further than that, when the attention is absorbed in the search for abstract relations, there is a tendency to suppress the revival of sensational impulses, for these might confuse rather than increase the effective working of attention. The law of economy operates to suppress the useless and to emphasize that which tends to further the end involved. It seems, moreover, that a continuous tendency to suppress concrete imagery leads to atrophy of the functions of revival in that direction or, in other terms, tends permanently to block expression of that type. We recall as a familiar instance of this the regret expressed by Darwin in his later life that he was no longer able to enjoy music or poetry which had been an important part of his life in his earlier years. Coupled with this regret was a feeling that such loss of concrete appreciation had probably caused a deterioration of a moral kind.

It has been suggested as an objection to the above theory of imagination that people who have lost an arm or a leg still have the feeling of a 'phantom' arm or leg, which, according to some, seems shrunk and smaller than the other. The evidence is by no means unambiguous, but it would seem that in such cases it is visual imagination and not tactual which furnishes the pattern. Dr. Head has shown that the image of the phantom limb, which may exist in cases of lesions on one side of the cortex, has no value in recognition or postural adjustment. If the patient's affected hand is moved after his eyes are closed, and he is asked to indicate its position, with the other hand, he will point to the place where it was when he saw it. As to the sense of shrinkage or shortening, that would seem to be a matter to be interpreted in terms of tactual sensibility. Since the sensational response to the projected sensory lines is actually cut short and shrunk in bulk, the fact would be just what we should expect on the theory we have advanced. On the other hand, if the sensory processes are cortically produced there seems to be no reason for any shrinkage. Another objection which has been raised is that persons whose eyes have been removed, including the retina, still have visual imagination. It is necessary to have more definite facts before attempting to answer such an objection. In the first place, the term image has been and is a very ambiguous word; and it is therefore difficult to know what people mean when they speak of an image. There would still be meaning patterns directed towards the eyes, though there were no concrete imagery. Again, the actual facts of the operations would have to be established. In the nature of the case there could be no objective test, and the introspective test must always be uncertain. Furthermore, we are under a peculiar difficulty in the case of the end organ of vision, owing to its being, as it were, a projected part of the cortex. We cannot be sure how much is included in the organ of vision.[1] But in both of the above objections the facts are still too much in the nature of old wives' tales to be taken seriously; the important thing is that the theory should meet the ordinary and established facts.

Suppression and Neural Levels

The sorting and integration of sensory impulses would be useless except for another function of the nervous system, viz., that of selective inhibition or, to use Dr. Rivers's term, suppression. A certain 'vigilance' is exercised by each neural level which permits only those impulses to pass which fit in with the general set. There is a constant struggle for dominance amongst incompatible impulses at the various levels. Were all allowed to reach the highest level of discrimination, there would be endless confusion. But only the victors reach the higher levels. Which among several competing impulses emerges as victor not merely depends upon the quality, intensity and duration of the preceding impulses but implies the entire history of the nerve-center,—the duration of previous lines of motion, whether of race history or individual history, as structure or potential energy. And we must take account not only of the set of the individual center, but of its relation to the levels above it which under normal conditions to a large extent control its behavior. Prepotency is, therefore, a very complex affair and can be studied by us only as revealed in function.

It is easy to illustrate the fact of suppression in connection with sensory impulses. Suppose you apply a metal disc of

[1] If in the case of vision the sensory neurones of some center or perhaps the receptor cells in the cortex itself have a differentiation corresponding to that usually attributed to the retina, then when the synaptic connections with the centrifugal sensory fibers are once established in the cortex, the centrally initiated motion would only need to travel to the synaptic junction of the centrifugal with the centripetal fibers next below the center in question to produce the required afferent current.

a temperature of 45° C. to the back of your hand. You stimulate not only the hot spots, but the cold spots, the pressure spots and the pain spots. Yet the sensation is one of pleasant warmth. The other impulses, under normal conditions, do not reach the cortex. This does not mean that they are absent. Pathological cases show us that they are always present, ready to come to light when the epicritic control is removed. Visceral sensations are always present, but it is only under abnormal conditions that they reach the highest discriminative centers, and this because their information becomes important for self-preservation. The suppressed sensations, moreover, may count, even when they do not reach the higher levels, in guiding reflexes of the lower centers.

It is, however, not only in connection with sensory impulses that the nervous system selects the compatible and suppresses the incompatible. The principle holds throughout. Dr. Rivers[1] has shown how within the cortical level there are various strata, due in the first place to organic evolution, with recapitulation in part at least of its main periods, but overlaid in the course of individual development. Here we have again the struggle for dominance of the various tendencies of the more primitive levels, on the one hand, and the epicritic control by the later levels, on the other. The earlier strata, such as the infantile level, the childhood level, the adolescent level, etc., do not disappear in the later life of the individual, but the crust of custom of the upper level exercises strict 'vigilance' over them, and we may not under ordinary circumstances suspect their presence. Their suppression may, however, very much complicate the life of the individual; and they are ready to assert themselves with excessive vigor when the ordinary 'vigilance' is relaxed. How to reduce the suppressed tendencies to a minimum by integrating them into a comprehensive scheme and sublimating them into the activities of normal life is a problem not only for the physician but for society at large.

[1] W. H. R. Rivers, 'Instinct and the Unconscious,' 1920.

Neural Functioning Illustrated in More Complete Reactions

Our emphasis so far has been upon the sensory and cognitive functioning of the organism. But we might have selected the more complete reactions with equal effect. The cognitive aspect does not exist by itself, but is bound up with the executive and motor aspects, and their complicated systems of patterns. The more thoroughgoing is the cognitive or informative function, the more definite and adequate is the affective or motor aspect. In the case of the reflex arc, the simplest complete neural act, we have the selection of sense impulses, the suppression of incompatible impulses, the integration of impulses into the prevailing pattern and finally the projection of lines of action to the part affected. This of course assumes the intactness of the central nervous system. In the conflict for dominance in the neural centers, the physical law of summation of forces, as Sherrington[1] points out, does not hold. When the flexor reflex and the extensor reflex conflict, the result is not an algebraical summation, but one or the other becomes prepotent; the other is suppressed. Orderly succession of adjustments means the supersession of one reflex or group of reflexes by another. It means the passing from one reflex pattern to another, determined in part by the quality and intensity of the stimulus, in part by the set at the time of the neural center,—this set being due to its previous stimulation and constitution on the one hand, and its relation to the higher centers on the other. Thus coördination is established as between reflexes, and the ends of the organism are furthered.

The simplest neural centers thus reveal the essential traits of group conduct. "The nervous system," says Sherrington, "is in a certain sense the highest expression of what the French physiologists term the *milieu interne*."[2] We may look at nerve-cells from three points of view. In the first place, we must take account of them as individuals. "Nerve-

[1] Chas. S. Sherrington, 'The Integrative Action of the Nervous System,' 1906, 112, 118.

[2] *Ibid.*, p. 4.

cells like all other cells lead individual lives—they breathe, they assimilate, they dispense their own stores of energy, they repair their own substantial waste; each is, in short, a living unit, with its nutrition more or less centered in itself." [1] In this respect nerve cells are like other living cells. In the second place, nerve cells present a high degree of contagion. "They have in exceptional measure the power to spatially transmit (conduct) states of excitement (nerve-impulses) generated within them.[2] When we approach the problem from the social point of view we find a similar relation between individual organisms. This phenomenon is especially prominent in the case of crowd excitement and certain artificial and pathological states. In the third place, the reactions of nerve cells have the function of integration. "In the multicellular animal, especially in those higher reactions which constitute its behavior as a social unit in the natural economy, it is nervous reaction which *par excellence* integrates it, welds it together from its components, and constitutes it from a mere collection of organs an animal individual." [3] The simplest level of conduct, that of the reflex arc, thus foreshadows the characteristics of the most complex levels of behavior, including the interactions of the highest organisms.

If we turn now to the instincts and emotions, we find the same fundamental functions of selection, suppression, integration, and projection. They have, as McDougall has pointed out, their cognitive, affective and motor aspects. Cannon[4] has shown that emotions owe their specific and unique character to their being neural pattern reactions, resembling in this respect reflexes such as sneezing, though of course vastly more complicated. "They are ingrained in the nervous organization," and respond "instantly and spontaneously when the appropriate 'situation' actual or vividly

[1] *Ibid.*, p. 2.
[2] *Ibid.*, p. 2.
[3] *Ibid.*, p. 2.
[4] See Walter B. Cannon, 'Bodily Changes in Pain, Hunger, Fear and Rage,' 1920, especially pp. 280–283.

imagined is present." They are, among the higher animals, for the most part cortical patterns, but Sherrington's experiments on decorticated dogs and cats show that 'at least one such pattern, that of anger, persists after the removal of the cerebral hemispheres.' We cannot, it is true, neglect expression as a factor in emotions. They 'gain expression through discharges along the neurones of the autonomic nervous system,' and in this way get what James called their 'bulk.' But the setting off of the autonomic system depends upon the intensity of the emotional stimulus rather than its specific character and could not possibly differentiate the emotions.

That the emotion patterns are genuine energy patterns is shown by their effect upon secretions and muscular contractions and by their stimulation of the adrenal gland which increases blood sugar in intense excitement. It is also shown in pain and great emotion by the 'hastening of the coagulation of blood' and in general by the 'energizing influence' which 'the fierce emotions' exercise.

The sentiments, again, as Shand[1] has shown, manifest still greater complexity of pattern. This is due in part to inherited connections between emotions. "Every primary impulse, whether it is independent or belongs to a primary emotion, is innately connected with the systems of fear, anger, joy and sorrow in such a way that when opposed, it tends to arouse anger, when satisfied, joy; when frustrated, sorrow; and when it anticipates frustration, fear; these symptoms being similarly connected together." In the case of such a complex sentiment as maternal love, the innate connections are immensely complicated. But the complexity of patterns increases vastly in the course of individual experience as the emotions become organized in terms of patterns of imagination and their objective implications. In general, "every sentiment tends to include in its system all the emotions, thoughts, volitional processes and qualities of character which are of advantage to it for the attainment of its ends, and to reject all such constituents as are either superfluous or antagonistic." The sentiments tend to form a hierarchy in

[1] See Dr. A. F. Shand, 'The Foundations of Character,' pp. 35–106.

which greater systems are superimposed upon lesser systems, including the bodily systems,[1] until a character is formed,—the more inclusive systems exercising 'vigilance' over the more primitive. They are in Shand's phrase, "forces; they work in certain ways and in certain directions. They are within us to perform certain functions."[2]

That the meaning patterns of the cortex are an integral part of the complex volitional arc and issue in certain definite motor patterns for the control of conduct is attested by the whole trend of modern psychology. The motor patterns owe their definiteness and control to the meaning patterns and in turn make them effective. No impression without expression is a psychological commonplace and holds of the cerebral levels as well as of the lower levels. Language patterns are only one form of this expression, though socially a very fundamental one. All the facts go to indicate that we must regard the nervous system as a hierarchy of energy systems with increasing complexity and interconnection as we proceed to the upper centers. Each level has its own quality or functions which pathological evidence has enabled us to dissociate from the total system.

We must not forget the integrity of the nervous system, when we talk about the reaction of nerve centers. It is a singular fact that the lower centers owe their definite and stereotyped functioning to the control of the upper centers. In the case of stimuli of high intensity, the control is broken; and then the lower centers act in an indeterminate and unpredictable way. When through accident the lower spinal centers become separated from the upper part of the nervous system, they respond by mass reflex and in other diffuse ways. They no longer project their response to definite points, but relapse to the old defensive reactions of withdrawal of the entire part of the body.

If it is true that the lower centers are dependent upon the upper, it is no less true that the upper are dependent upon the lower. This dependence, moreover, is not merely an execu-

[1] *Ibid.*, p. 27.
[2] *Ibid.*, p. 178.

tive dependence but concerns the whole life of the upper centers. We all know how deeply rooted are the instincts and emotions in the primitive reflexes of the organism. And the sentiments in turn are rooted in the emotions. But imagination, too, even in its highest stages of creative organization, is closely dependent upon the primitive part of us. I have in mind, not merely the serious complications of the sex life which often accompany intense work of the higher type, but the more positive fact that our higher activities draw their energy, color and zest from their aliveness to sense experience and the passions. This will no doubt be recognized with reference to the more sentimental imaginative activities, but it is true of abstract thought, too. No person who is a mere intellectualist is likely to make any profound discovery or to move the imagination of human beings. The really great thinkers are poets at heart. And it is when we *express* the emotions rather than when we *repress* them that thought takes wings, that creative imagination comes to free and momentous expression. Your dry as dust intellect may do valuable secondary service, but it is not likely to do first class work. You must have a *passion* for beauty or your fellow men or something greater than yourselves to sustain great thought. There is something almost infantile and primitive about genius that ensures youthful freshness to its work and makes its world a world of perpetual wonder. This is merely another way of saying that the great and fruitful intellect is not a mere cerebral language machine but lives clear down to his toes. All the levels are tapped and converge to give reality to his thought. The whole organism, and not least the despised parts below the diaphragm, contribute their vital share to the real life of creativeness. Your whole cubic capacity must be alive, to borrow an expression from William James, if you are to do your best intellectual work.

Consciousness not an Explanatory Category

So long as we limit ourselves to the individual organism and its implications, we can project all our facts on one plane, viz., that of physiology, even though we are under the necessity of borrowing some of the terms that have been associated with psychology. In the first place, there is no need to take account of consciousness. We may regard it as a universal property. It is a fair assumption that it is present on all the levels, even though it is only on the cortical level that it becomes significant and therefore known. There are limiting cases of well-nigh pure perception in our experience, but these are remembered because they issue into processes which have meaning. Consciousness in any case accounts for no processes. These must be explained in terms of our reaction patterns and their lines of relation to the terminal organs which furnish our data. Consciousness is everywhere a neutral light. It is not consciousness that colors the processes. It is they that color it. It is not consciousness which gives unity to our energy patterns. It is they which give unity to it. Consciousness controls no reactions. These are controlled, in so far as they are controlled, by the system of energy patterns of each level and of the whole. Consciousness is therefore useless for explanatory purposes and we can cancel it, as we cancel a factor in an equation when it figures in the same way on both sides. To be sure, there is the fact which Alexander has called 'enjoyment'; but this owes nothing to consciousness except the bare awareness; and in any case the fact would not be patent in a solipsistic world. There are, of course, different levels of control with their conflicts and subordinations. It is true that the great mass of our life lies below the cortical attention level with which we usually identify our ego. But this complexity of levels and controls is in no wise explained by consciousness. I suggested some years ago the awkward adjective, subattentive, for the levels below the customary crust.

The concept of consciousness has long been a stumbling block to a consistent account of behavior. It has been felt that there is an impassable gulf between consciousness and physico-organic causes and effects. Huxley says: "How it is that anything so remarkable as a state of consciousness comes about as the result of irritating nervous tissues, is just as unaccountable as the appearance of the Djin when Aladdin rubbed his lamp in the story." And Tyndall says: "The passage from the physics of the brain to the corresponding facts of consciousness is unthinkable." The answer is that there is no such passage. The physiologist in describing behavior in terms of physico-organic mechanism never runs across the fact of consciousness. It is not an energy category and therefore does not figure in the chain of causes and effects. It constitutes another dimension from energy at any of its levels, physical, organic or mental. It is not originated by energy changes, neither does it originate energy changes. It is therefore irrelevant to causal explanation. It is relevant only when we deal with the significance of behavior. And what it contributes is merely awareness.

Mind as a Social System of Patterns

If the study of individual behavior in the abstract does not require the concept of consciousness for explanatory purposes, neither does it require the concept of mind. It is entirely arbitrary to identify mind with any special level of the nervous system. All the levels, we have seen, have the same essential characteristics. They all discriminate, inhibit, reinforce, integrate, and project in accordance with their unique energy patterns and their relation to the economy of the whole. Individual psychology is an unreal abstraction and in fact is not psychology at all. It is a misnomer. We can, it is true, study the human individual as a system of indicative signs or implied meanings, just as we study geological strata or the life of plants. But this is behavior as the physiologist studies it and should be called what it is, viz., physiology.

The issue has been confused by the fact that psychology so-called has followed no consistent principle of explanation. When it has dealt with the more elementary processes of habit, emotion and sense perception, it has leaned on physiology or pretended to do so. When, on the other hand, it has dealt with the more complex processes, such as the sentiments, thinking and will, it has fallen back on social psychology. It has as a matter of fact started with the adult behavior of the psychologist as differentiated, integrated and stereotyped through social relations, but has abstracted from those relations. Instead of treating of the individual within the matrix of social relations, under the control of which he acquires his habits, attitudes and perspectives, it has made him an abstract entity. It has forgotten that the world as it exists for the psychologist, with its things, qualities and relations, its values and attitudes, its play of free ideas and its organized will, is the product of social communication and interaction, made possible by a highly evolved language and tradition. The physiologist, who starts with the simple reflex of the nervous system and follows this through more complex levels of selection, integration and control, at any rate is consistent in his explanation. In the most complex behavior of the organism he sees the play of ever more complex mechanical causes. And though these may not furnish the sufficient reason of the behavior, they at any rate are an index of behavior and make a consistent story. If consciousness is present in this account it is at any rate irrelevant so far as explanation is concerned. It is assumed that the organic mechanism in its entirety,—neural, chemical, physical,—would indicate all the various complexities of behavior, could we follow it, which we cannot. At any rate, it is all we have so long as we deal with the individual organism in the abstract.

Mind is essentially a system of intersubjective meanings or valuations and of controls as resulting therefrom. We may speak of mind as a superorganic system of relations as we may speak of life as a superchemical system. In any case each is a unique type of energy system with characteristics of its own. In the absence of expression, mind is inchoate and ineffective. It can at best be regarded as potential from the spectator's point of view. The formative idea is the soul whether in the individual or in the group. And this is created in social relations and can only be understood through social relations. Mind comprises, it is true, relations to the physical world as well as to the social. But the former exist as meanings only because they are selected and integrated into social patterns. The physico-organic concept of mechanism employed by physiology is itself such a socially constructed system of patterns and should be worked so far as it can be worked. But it proves inadequate when we come to deal with social relations. I may add in passing that it is not necessary that the formative idea or system of ideas should be conscious at all times. It is at most only partly conscious at any one time; and at times, as in sleep, it may not be conscious at all. The mental patterns are, no more than the neural patterns, dependent on consciousness for their existence, though they cannot have significance without consciousness.[1]

It is only when we are concerned with expressive signs, with social relations, that the concept of mind becomes necessary. Here we have a new perspective of relations, a new reading of the facts. We no longer deal with neural patterns except as instrumental to the new type of relations. We are concerned with a new type of energy field where will relations, the craving for association and reciprocal sympathy, the intention to express and to be understood, the desire to share in a common life become the important facts. We have to do with teleological causes—the realization of needs and interests in social relations. We are concerned only indirectly and instrumentally with mechanical causes and effects. Here we have selection, inhibition, facilitation, reinforcement and integration of conative impulses, obeying in the main the same laws that we have become familiar with in the physiological field. There is the grouping of like impulses with like, there is the struggle for dominance and the selective inhibition of the incompatible impulses, the facilitation of the compatible and their integration into a common direction by the controlling pattern or set of will relations. In this pattern, duration plays an even more important part than in the physiological patterns, for here we have the past conserved, not merely in the slowly formed patterns of bio-

[1] I have dealt more fully with the relation of the concepts of consciousness and mind in 'A Realistic Universe,' Part II., Macmillan, 1916.

logical heredity, but also in the cumulative tradition, embodied in language, art and institutions, and moulding the habits of each generation, through education and social sanctions, into conformity with itself. And we have the projection of the future, which is not merely the projection of the past but has a forward-looking implication—due to our being part of a larger cosmic order which we cannot understand but which somehow determines our course and our survival conditions. We have fusion, as in the orchestration of a vast number of musical instruments of varying timbre, of the various complex energy patterns of individuals and groups into a common tradition and a common life; and here, as in the physiological field, we have to take account of the quality, the intensity and the number of components as well as the total situation of the controlling energy field. This forms a continuum of a unique sort, cutting the individuals into various planes, protopathic or epicritic, according to the type of control and the situation at the time.

The fact that we are so organized that every instinct and emotion is provided with selective inlets or receptors for sympathetic response to corresponding instincts and emotions in others and that, further, we can only realize our nature and find our satisfaction in association with others goes to show that the evolution of life has assumed a new type of energy pattern in which the group is the unit rather than the individual, just as in the multicellular organism the organic whole becomes the unit of control rather than the cell. The types of group-unity vary all the way from the nutritive unity in the lowest stages of animal life, through the organic family of the bee, to organized self-planning society. The future is dark to us, but judging from human history so far and from our newly gained psychology of human nature, it would seem that if the race is to survive it must evolve a pattern of social relations which furnishes, on the one hand, a maximum freedom of individual human nature and, on the other hand, a maximum of sympathetic coöperation for common ends. Only such races as can meet these two tests are likely to survive in the long run.

Whether we translate the facts into mental or physiological terms, it is clear that we must explain behavior in terms of energy systems or patterns and their action, reaction and interaction with the energy patterns of the environment. We cannot on the social level, any more than on the physiological, explain behavior in terms of consciousness. The evidence shows that not only are the sense qualities and affective qualities independent of consciousness but the functions of selection and integration, or, in an older terminology, analysis and synthesis, must also be accounted for in terms of energy patterns—neural or mental according to our approach—and independently of consciousness.

The subject-object relation now becomes one of significant selection on the basis of past and future perspectives. With the aid of language mechanisms, meaning patterns, ingrained by heredity and organized by personal experience, function as judgments, expressed, supplemented and corrected in terms of social relations, present and past. Selected impulses now become data for conscious construction and reconstruction to meet the needs of life. And life includes pure thought. It takes delight in successful action, theoretical as well as practical. But in any case, the process is a trial and error process. The final test of proper thinking is proper conduct within the dominant purpose. This is as true in the realm of theoretical construction as in the sphere of practical judgment.

Mind patterns may express themselves not merely in immediate social relations, but also in forms of matter, institutions and language. A great genius may express his meaning in musical patterns of vast complexity like a symphony of Beethoven or in sculpture like the Zeus of Phidias. He may express his thought in the building of cathedrals or in systems of philosophy or in great epics. And these patterns, with the will communicated to them, continue to live in the history of the race long after the creator has passed away, thus giving his mind a continuous vitality in history for long periods of time—perhaps latent for centuries but always ready to spring into renaissance when the proper conditions arise. It is so that English culture has been organized and continues to be organized through the ongoing genius of a Shakespeare, who in turn is ever reconstructed in the living tradition of the race. So Plato lives through the centuries and makes us Greeks, while we in turn give his genius the coloring and vitality of our time. Such influences are lines of motion entering into ever new systems, yet always retaining their individuality as the historic pageant passes, dwindles or grows, through the endless perspectives of space-time.

Having once been compelled to introduce the conception of mind in order to understand social relations, we can now return to the individual and study his behavior from the social point of view. Strip the individual of all social reference and nothing remains but a bare physiological automaton. But it is different when we consider the individual as part of the group. It is obvious that meaning and language are the articulation of the need for expression and reciprocal sympathy, *i.e.*, they are group planes which intersect individuals. Creative imagination, whether concrete or abstract, exists to organize and give form to this need for expression and mutual understanding. The sentiments are emotional patterns moulded upon social objects in the course of group relations. Even the instincts are all equipped with inlets for social sympathy. They are highly contagious. The cerebrum, in short, becomes an organ for social interactions, past, present and future, *i.e.*, it is an organ of mind.

As for the other neural levels, they too acquire new significance. It has been customary to start with reflex arcs and to judge the other reactions on that type. If we start with the assumptions of the physical sciences, it is natural to treat this arc as purely physico-mechanical. And having once made this assumption, there is no place where we can stop; and we are under the necessity of projecting the whole of conduct on the plane of the physico-mechanical. But we can now interpret the functioning of the lower centers from the social point of view. We can project the functioning of these centers on the plane of mind. They have their own reality, their own contribution to make to the life of social relations. This fact is unfortunately overlaid and obscured in our artificial society. The cortex is preëminently an abstract language mechanism and its increasing tyranny over the lower centers, owing to extreme centralization of functions, tends to suppress unduly the more primitive functions. Under artificial conditions such as hypnosis and the spontaneous trance, and in the less abstract life of primitive peoples, we have an opportunity to observe a more immediate and more nearly protopathic sense of social relations which is largely suppressed in us except under conditions of extreme crowd excitement. The increasingly abstract epicritic control gives us our intellectualistic theories of individualism, so foreign to primitive society. We must, I think, presuppose an immediate protopathic sense (however overlaid and difficult to disentangle) of social presence which constitutes the sense of reality of social relations. It furnishes the primitive continuum which is canalized and overlaid by the later epicritic cognitive functions and only under unusual conditions rises into the attention-field. In genius there seems to be an unusual persistence of the protopathic type of immediacy and hence an unusual liveliness of the immediate and first-hand values.

The question may well be raised whether the extreme cortical centralization of the organism, with the consequent suppression of the primitive sense of rhythm, movement and concrete imagination, which is the course of civilization, is not a tendency to senility and therefore self-defeating. If the psychic attitudes make a difference, directly and indirectly, to the blood, and if the blood in turn makes a difference to the germ-cells, then it may well be that the absence of proper stimuli and interactions may cause certain tendencies in the germ-cells to atrophy or at any rate to make them available only under such exceptional conditions as to make them of little service. This should give us pause in our artificial and murderous civilization.

SOME UNUSUAL VISUAL AFTER-EFFECTS

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Delayed After-Sensations.—During the summer of 1918 a large map of the battle front in France was tacked to the wall of my room. Just before going to bed I usually traced the day's progress in various parts of the front on this map, moving the eyes slowly to and fro. The room was dark except for a movable electric light which, as I turned it, illuminated one part or another of the map. The map was of the sort that features swamps and forests as well as roads and boundaries.

Several times after studying the map for perhaps half an hour I undressed quickly and turned out the light. I then noticed in the field of vision (with eyes closed) rather distinct pictures which bore considerable likeness to the tracings on the map. There were networks of lines like the roads, and patches like the swamp markings. These pictures were not stationary, but moved slowly to and fro. At no time was there a recognizable reproduction of any part of the map.

I have noticed a similar phenomenon several times after reading at night in bed in a rather dark room with the page of the book brightly illuminated. After the light is out I see impressions resembling printed words and letters. These after-effects are not stationary, but seem to move very much as the printed page moves in the visual field in reading. I have never been able to identify positively any printed word. Occasionally there is a strong suggestion of some familiar word, such as 'the'; but I am never sure that the significant part of the impression is not supplied by the central imaging process. Occasionally when playing solitaire card-games in the evening I have had after-sensations resembling playing-cards after going to bed; the impressions are always too indistinct to identify any particular card.

The most satisfactory experience of this type occurred recently. I was examining under the microscope some slides showing sections of the cerebellum. It was late in the afternoon; the room was quite dark except for an electric stand-light centered on the mirror and reflected through the slide to the eye-piece. On account of wearing spectacles the field seen in the microscope is comparatively limited.

I was observing the nerve cells and axons especially, and moved the slide slowly from side to side in a zigzag, so as to inspect the whole section on the slide. Three slides were examined in this way, for about half an hour. Then, being sleepy, I turned out the light and lay down on a couch; the room was in twilight darkness. I fell asleep almost at once and slept some 15 minutes.

On waking I looked at my wrist watch, but immediately closed my eyes. I was fully awake. In the center of the visual field I observed a small circular area of intense brightness, corresponding to the bright field of the eye-piece previously before the eyes. The rest of the field was dark. The bright field was filled with black spots, like nerve cells, which were supplied with long fibers like axons. The contents of the bright field moved slowly to and fro in a manner corresponding to the zigzag motion of the microscope slide. I observed this after-sensation very carefully for several minutes. The lighted area (about the fovea) seemed about as bright as the field of the original. The moving figures were very distinct, and were unmistakably similar to nerve-cell bodies and fibers. The entire impression was apparently peripheral; none of the significant features were furnished (so far as I can judge) by central imagery elements. While I could not identify any momentary impression as an exact reproduction of any definite portion of the slide, the arrangement of cells and other elements was strikingly like that in the original.

These moving after-sensations lasted about 15 minutes. I opened my eyes two or three times during the observation, and the after-sensations always returned on closing them again. An engagement prevented the observation from being continued to determine its maximum duration. I wish to emphasize strongly the *definiteness* of the figures seen, their *motion*, and the fact that they appeared unmistakably of *retinal* origin.

Prolonged After-sensation of Glare.—Sometimes on a misty day, on going from daylight into a dimly-lighted room, a portion of the visual field lights up with a bright glare. Once this came on as I entered a physician's waiting-room, so that there was ample opportunity to observe its course. On this occasion the glare effect covered nearly half the field and was shaped like a circular disk. It was so thick that nothing of ordinary brightness could be seen through it, though the remainder of the field was perfectly distinct. A small clear spot was noticed within the blinded region, near the edge. This clear spot gradually enlarged and at the same time the blinded region grew smaller. The central clear spot finally reached the clear field at one place, so that the area of glare became crescent-shaped before it disappeared. The phenomenon lasted some fifteen minutes. The effect did not fade away, but the field cleared up from the edges. On another occasion the glare turned purple and quickly faded away. This time the room was quite light; the phenomenon lasted only two to three minutes. In no instance was there a definite objective stimulus to which I can attribute the glare. The effect is apparently due to some condition of the retina and to the general objective conditions of illumination. I have learned to expect the glare effect beforehand, when the eyes are 'dazzled' by a bright mist or something similar. It may be added that for years I have made a practice of observing ordinary after-sensations, so that I am able to prolong them considerably longer than is usual.

Involuntary and Voluntary Visualization.—As a child I had the capacity of arousing very distinct and vivid visual impressions. In our household family prayers were held daily. Time after time, with eyes closed, I observed the play of colors before me. The impressions often took the form of colored patterns, somewhat like kindergarten designs. These patterns were continually moving or changing their colors or form. The effects were somewhat like those seen in a kaleidoscope except that the patterns were much more regular. They arose and changed of their own accord and were not subject to voluntary control. Often they were as vivid and clear-cut as actual sensations. These phenomena occurred from the age of eight (or earlier) to twelve or more, so that this report after forty years is of little value without corroboration. I am personally convinced that they were retinal phenomena.

Later I was accustomed, with a cousin of my own age, to try to 'see stories' with closed eyes in the dark. Whether the stories he told were actually visualized I cannot say. In my own case they were a sort of visual imagery, often quite vivid, but not so 'real' as after-sensations or as the patterns just described. Sometimes the changes were voluntary, at other times they seemed to be independent of every effort. So far as I can recall at this distance of time, the human figures and other familiar objects in these pictures were very distinct and detailed.

This cultivation of visualization continued till about the age of eighteen, when under a new environment the practice dropped away almost at once. For many years my visualizing capacity was little used and seems to have degenerated, although I worked considerably with visual after-sensations.

Within the past two years I have endeavored to renew the practice of visualizing with closed eyes. At first the results were meager; I saw only retinal light and fleeting after-sensations. Gradually the visualizing power has returned, and I am able to picture scenes voluntarily, though not so vividly as in adolescence.

I obtain these visualizations by concentrating the attention on the retinal field, endeavoring to form pictures out of what I see, and projecting them into a real scene. At first I see only the play of indefinite retinal light, which I weave into a picture with the help of imagination. Then all at once the picture becomes vividly real for an instant. I have never succeeded in prolonging these images. The effort to observe them attentively always throws them back into their former state; and often the attempt to control them voluntarily has the same result.

The purely involuntary type of visualization, which is apparently the phenomenon observed in clairvoyance and crystal-gazing, occurs infrequently in my case; but I have occasionally had experiences of this sort in an unmistakable form. In a dark room with eyes closed a definite scene will appear before me in apparently as bright an illumination as daylight. I seem to be looking through my closed eyelids. The scene is apparently as real, as vivid, as detailed, as an actual landscape. The phenomenon lasts not more than a minute. I have never been able to hold it long enough to notice any change or movement. It is a scene—not a happening. The two most vivid cases occurred quite automatically, either as I was dozing off and for some reason came back to consciousness; or immediately on waking during the night. Once the scene was a tropical landscape, with palm-trees and a body of water. It was clear and detailed and appeared so real that I was surprised to find it unchanged by winking.

Relation to Earlier Work.—The types of phenomena reported above have been little investigated, though they have an important bearing on the mechanism of memory and on the relation of sensation to central imagery.

V. Urbantschitsch reported in 1903 [1] that in early life he was able voluntarily to call up color impressions with closed eyes. This power has diminished in later years; he can still bring up colored pictures but only with difficulty. This experience is apparently similar to my voluntary visualizations. In a later paper (1905) Urbantschitsch reports[2] that after an excursion in the country, on closing his eyes, he is often able to call up pictures of landscapes, with groups of trees and bushes. These visualizations may recur for several days after the original impression. He considers them memory-images rather than after-sensations. This expe-

[1] 'Ueber die Beeinflussung subjectiver Gesichtsempfindungen,' *Pflüger's Archiv*, **94**, p. 423.

[2] 'Ueber Sinnesempfindungen und Gedächtnisbilder,' *Pflüger's Archiv*, **110**, p. 479.

rience resembles the delayed after-sensations mentioned in the beginning of the present paper, except that the lapse of time is much greater—days instead of less than an hour. If the two phenomena are really due to the same neural processes, they bear on the relation between retinal and central processes.

G. J. Burch reported in the same year[1] an experience similar to my microscope effect. On his way to the laboratory he stopped several minutes to watch a pair of birds building a nest in the branches of a tree. On reaching his laboratory and turning out the gas in the dark-room, he obtained an after-sensation of the gas-flame for about ten minutes; then came a retinal fog, and afterwards there developed a picture of branches such as he had seen around the nest—a delayed after-sensation.

The first attempt at systematic investigation of these phenomena was made by V. Urbantschitsch.[2] Urbantschitsch distinguishes two classes of visual memory images (Gedächtnisbilder): (1) Simple representations (Vorstellungen, Bilder der Erinnerung), and (2) Visualizations (Anschauliche Gedächtnisbilder, Bilder der subjektiven Anschauung). "In the first case the object formerly seen is merely represented, in the second case it is subjectively seen again." [3] The latter phenomena were subjected to various experimental modifications by the author. It is not clear how he distinguishes them from after-sensations.

More recently these phenomena have been made the subject of a series of experimental studies by E. R. Jaensch and his pupils in the Marburg Psychological Laboratory. Two of these studies were published in 1920 [4] and others are in progress.

[1] 'On Colour-Vision by Very Weak Sight,' *Proc. Roy. Soc.*, 1905, 76 B, pp. 211–2.

[2] 'Ueber subjektive optische Anschauungsbilder,' 1907.

[3] *Op. cit.*, p. 152, cf. p. 1.

[4] Paula Busse, 'Ueber die Gedächtnisstufen und ihre Beziehung zum Aufbau der Wahrnehmungswelt,' *Zsch. f. Psychol.*, 84, 1–66. E. R. Jaensch, 'Zur Methodik experimenteller Untersuchungen an optischen Anschauungsbildern,' *Zsch. f. Psychol.*, 85, 37–82. Cf. E. R. Jaensch, *Zsch. f. Psychol.*, Erzbd. 4, 1909, pp. 386–387. The present writer had not seen these studies when the first part of this paper was written. He is indebted to Professor E. B. Titchener for bringing the work to his attention.

Jaensch distinguishes three types of visual after-effect: (1) Nachbilder, (2) Anschauungsbilder, and (3) Vorstellungsbilder; which will be translated *After-sensations*, *Visualizations*, and *Memory Images*, respectively.[1] The Anschauungsbild or visualization is intermediate between the other two. Jaensch and Busse consider them as three grades of memory (Gedächtnisstufen).

The Marburg subjects were chosen with reference to their ability to obtain vivid visualization. It appears that some capacity for visualization is present in a large proportion of children; examinations conducted by the Marburg laboratory indicate that at least 37 per cent. of all children possess it in some degree. For the Marburg studies a number of young observers from 11 to 17 years of age were used, together with many older observers capable of visualizing.

After-sensations were obtained by the subjects after a 40-second exposure of the visual stimulus, visualizations after a 15 or 20-second exposure, and memory images after a 5-second exposure. The intensity of the visual stimulus is not stated, though this would seem to be an essential factor in repeating the experiments. After-effects of all three types were obtained *with open eyes*, and were usually projected onto a blank cardboard background. For the purposes of the experiments lines and other objective figures were placed on this same background. The subjects were able to hold the after-effects and compare them with the objective figures.

The experiments aimed to discover definite laws governing visual after-effects, comparable with the laws of visual perception. Busse found that if the head be turned about the sagittal axis after the phenomena has been obtained, the memory image deviates from its original projective position less than the after-sensation; *i.e.*, there is more change with reference to the shifting optical axes in the memory image than in the after-sensation. The change in the visualization picture is intermediate between the memory image and after-sensation. The area of the field of vision was found to be

[1] The first and third of the English terms may be objected to as involving a theory of origin; but the second is freer from theoretical implications than the corresponding German term.

generally greater in the memory image. In general, memory images were flat, visualizations stood out in relief, and after-sensations appeared solid. Visualizations were compared with visual perceptions by means of a pair of (objective) threads and the after-effect of another pair of threads; it was found that the mutual influence of perception and visualization diminishes as the difference between the distances measured by the two pairs increases. After-effects are progressively less clear in detail as we pass from after-sensations through visualizations to memory images.

Jaensch, experimenting with visualizations, finds that both the law of identity of the binocular line of vision and the law of incongruence of the two retinal fields hold for visualizations, the same as for visual perceptions. Visualizations withstand voluntary control more than memory images; in other words, memory images are more plastic than visualizations.

The Marburg experiments had especially in view to demonstrate that visualizations are not produced and altered by suggestion, but are orderly (psychonomic) mental phenomena;—that they are as capable of definite experimental investigation as perceptions. The results reported, and the general agreement among the 100 observers after due allowance for differences in mental types, appear to substantiate this conclusion.

Physiological Basis of Visual After-effects.—The most important problem in connection with visual after-effects, in the opinion of the present writer, is their point of origin: Are they generated peripherally or centrally?

(*a*) In the case of *visual after-sensations* there seems no reason to doubt that they originate peripherally—that they are due to physiological processes in the retina itself.

(*b*) As regards *visual memories*, the accepted opinion among psychologists is that they depend upon cerebral retention: (1) It is difficult to see how such a vast number of visual impressions could be retained in the retinal substance for an entire life-time. (2) There is no known motor mechanism for the voluntary revival of such traces in the retina, even supposing them to have been retained.

The delayed after-sensations of Burch and the present writer weaken the first argument somewhat. It is evident that after-effects may persist in the retina despite subsequent, rather intense stimulation of the same retinal regions; that after a latent period of thirty minutes or longer they may give rise to renewed sensations. The question then arises how long this retinal retention can last. Are the after-effects reported by Urbantschitsch as occurring several days after his trip to the country phenomena of central origin, as he believes, or are they delayed after-sensations?

The second argument still holds. The absence of motor nerves in the retina supports the view that retinal retention is only a secondary aid to memory—that the stream of visual memories is controlled centrally and not through a retinal mechanism.

(*c*) Turning now to *visualizations*, the question of their source is somewhat perplexing. The writer's involuntary visualizations of childhood (*e.g.*, the changing color patterns) seem to be retinal; if not real after-sensations, they are apparently due to physiological processes in the retina. On the other hand, the visualization of the tropical scene was too definitely pictorial to have been caused by casual retinal stimulation; nor was it a delayed after-sensation, unless an effect of many years' standing or the amplified retention of some photograph or picture. Its definiteness of outline and content mark it as peripheral; the other evidence is entirely in favor of its central origin. Dream visualization and crystal gazing seem to belong in this category.

My voluntary visualizations in mature life appear to be based on casual retinal processes, which are amplified into meaningful scenes by the addition of central elements. Retinal stimuli are apparently essential to my present visualizations; in childhood they apparently played an unimportant rôle. Neither in childhood nor today have I succeeded in getting pure visualizations with open eyes, like Jaensch's subjects.[1] Were the Marburg experiments per-

[1] I can weave the indefinite markings of colored marble into scenes, see pictures in smudges, etc. My ability to recultivate visualization in later life may be due to

formed less rigidly, I should consider the 'Anschauungsbilder' to be a kind of prolonged after-sensation. As it is, they seem undoubtedly to correspond to my visualizations; but they are far more vivid, as shown by the fact that they persist in all their definiteness with open eyes.

While my own experiences may be brought fairly well into line with Jaensch's, my classification would be slightly different. At one extreme is the visual *sensation*, due to objective stimulation; at the other the *memory image*, which in my case is a thought rather than a visual picture. Between these extremes I distinguish three classes of visual after-effects which occur with closed eyes.

1. *Pure After-sensations.*—These are clear-cut and vivid. They are easily recognized as real; that is, there is no question of mistaking them for figments of the imagination. They bear all the marks of being aroused by retinal stimuli.

2. *Mixed After-effects.*—Here the after-sensations are not themselves definite, but they seem to be woven into definite figures and scenes by the addition of central imagery. If the image element predominates, the scene can be voluntarily controlled; if not, it is refractory. This type is recognizably different from the first; the pictures are not projected out, and there is no filling in of details. It is a partial visualization, but is largely dependent on retinal factors.

3. *Pure Visualization.*—The 'tropical scene' experience is the best example of this type. The visualized picture is even more vivid than an after-sensation. The details are lifelike, but in my case do not admit of careful examination; I should say that the outlines and content are not so sharp and clear as in pure after-sensations. The experience seems 'real,' though obviously it is not external. Dreams, hallucinations, and the phenomena of clairvoyance apparently belong to this type.

Visualization offers a promising field for research. The writer believes the visualization experience to be a combina-

monocular limitations. My left retina is normal but the left cornea is defective; so that distinct impressions are obtained only with the right eye. Possibly my after-sensations are more definite and persistent on this account.

tion of peripheral and central elements. The correctness of this explanation and the extent of the contributions from each source, would seem to admit of experimental determination. A retinal after-effect is affected very definitely by any new stimulus; while central after-effects presumably are little altered by external stimulation. Changes of general illumination, winking, eye-movements, attempts at voluntary control—one or more of these factors might prove a satisfactory criterion to distinguish the central from the peripheral elements in a visualization.

The radical behaviorist has a further task. If the phenomena which we call memory and imagery are determined in every case by motor factors, as the behaviorist asserts, he must discover the motor path leading to the retina which arouses visual memory images—for according to behaviorism the memory image is a motor-sensory affair.

Summary.—Several cases of long delayed after-sensations were described; also an unusually prolonged after-sensation of glare. Observations were reported of vivid visualization (both voluntary and involuntary) in childhood and in later life.

These personal experiences were compared with earlier observations and experiences. The first systematic treatment of the phenomena was by Urbantschitsch. Jaensch's recent work is an attempt to investigate them by laboratory methods. He finds that visualization pictures (Anschauungsbilder) can be obtained with open eyes; that they can be compared with objective perception-pictures, and that they can be subjected to rigid experimental tests. Jaensch divides visual after-effects into three grades: after-sensations (Nachbilder), visualizations (Anschauungsbilder), and memory-images (Vorstellungsbilder).

An important problem for future investigation is the source of these various phenomena,—how far they are due to peripheral and how far to central processes.